

US EPA RECORDS CENTER REGION 5



469366

QUALITY ASSURANCE PROJECT PLAN (QAPP)

**FORMER P.R. MALLORY PLANT SITE
CRAWFORDSVILLE, INDIANA**

PRINTED ON

NOV 13 1986

**QUALITY ASSURANCE PROJECT PLAN
(QAPP)**

**FORMER P.R. MALLORY PLANT SITE
CRAWFORDSVILLE, INDIANA**

November 13, 1986

Reference No. 1916

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U.S.A. 60604

Gentlemen:


Re: Former P. R. Mallory Plant Site
Crawfordsville, Indiana

As discussed during our meeting of October 27, 1986, we have prepared and enclosed a copy of the Quality Assurance Project Plan (QAPP) for work at the above noted site. The QAPP pertains to the site investigation activities outlined in the Response Action Work Plan (RAWP) for the site dated October 30, 1986.

At this time we anticipate commencing sampling activities during the week of November 24, 1986. Installation of the monitoring wells is tentatively scheduled to begin the week of December 1, 1986.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES


Robert T. Pyle, P. Eng.

RTP/js
Encl.

RECEIVED
NOV 14 1986
U.S. EPA, REGION V
WASTE MANAGEMENT DIVISION
HAZARDOUS WASTE ENFORCEMENT BRANCH

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QUALITY ASSURANCE PROJECT PLAN (QAPP)

Project Title: Former P. R. Mallory Plant Site
Crawfordsville, Indiana

Prepared by: Conestoga-Rovers & Associates Limited (CRA)

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Approved by: _____ Date: _____
Project Coordinator
Robert Pyle, CRA

Approved by: _____ Date: _____
Quality Assurance/Quality
Control Coordinator
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Approved by: _____ Date: _____
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Analytical Project Manager
Matt. Marks,
Hazleton Laboratories

QUALITY ASSURANCE PROJECT PLAN (QAPP)

Project Title: Former P. R. Mallory Plant Site

Prepared by: Conestoga-Rovers & Associates Limited (CRA)

Approved by: _____ Date: _____
RPM, Region V

Approved by: _____ Date: _____
Director, Central Regional
Laboratory

Approved by: _____ Date: _____
QA Officer, Region V

1.0 INTRODUCTION

The Response Action Work Plan (RAWP) for the former P.R. Mallory plant site in Crawfordsville, Indiana describes the emergency response and field investigation activities proposed for the plant site. The Quality Assurance Project Plan (QAPP) presented herein identifies the policies, organization, objectives, functional activities and specific Quality Assurance (QA) and Quality Control (QC) activities designed to achieve the specific data quality goals associated with the field investigation activities outlined in the above-referenced RAWP.

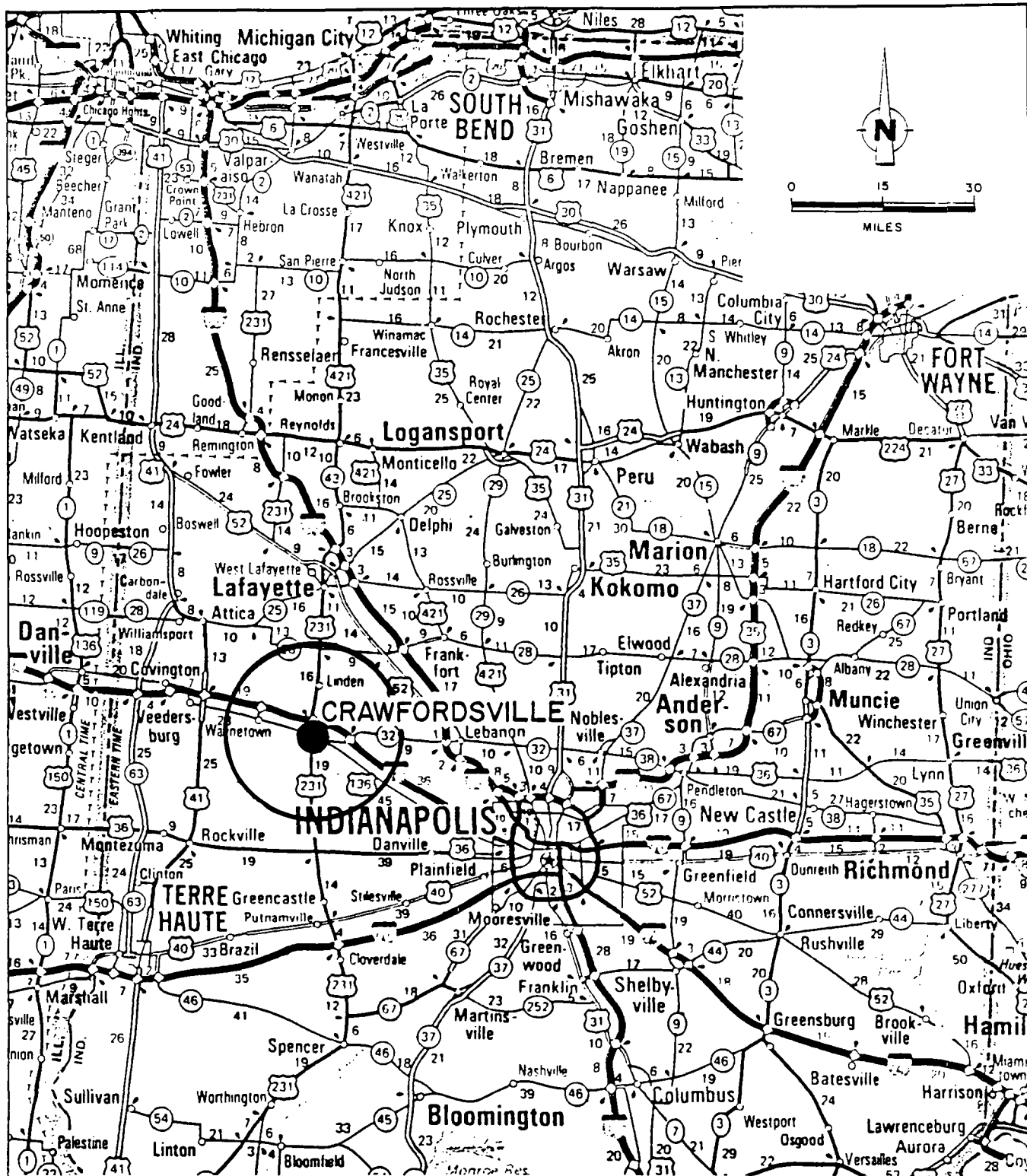
2.0 PROJECT DESCRIPTION

2.1 GENERAL

The former P.R. Mallory plant site referred to herein is located approximately three miles east of Crawfordsville, Indiana on the north side of State Road No. 32 (see Figure 2.1). The P.R. Mallory Company manufactured dielectric capacitors at the plant site from 1957 until 1969 when the plant was destroyed by fire.

The United States Environmental Protection Agency (EPA) issued an amended Administrative Order on August 20, 1986, which required the respondents (Duracell International Inc., Terra Products, Superior Moving), to implement emergency removal and field sampling activities at the plant site.

Field investigation and site assessment activities proposed in the RAWP for the former P.R. Mallory plant site in Crawfordsville (referred to as "site") include: soil, stream sediment and concrete sampling and analysis; ambient air sampling and analysis; surface water and groundwater sampling and analysis; a hydrogeological investigation; and a geophysical survey. The activities are designed to: determine the areal and vertical extent of residual contamination at the site following the



SOURCE : EASTERN STATES NORTH AND PROVINCE
AMERICAN AUTOMOBILE ASSOCIATION
1981 EDITION

CRA

figure 2.1
SITE LOCATION
Crawfordsville, Indiana

implementation of emergency removal activities; determine the extent and degree of groundwater contamination, if any, and the potential for lateral and vertical migration of contaminants; and determine the need, if any, for subsequent investigation and remedial action activities at the site.

A brief review of the history of the site and a description of the work completed to date are included in the sections which follow.

2.2 SITE BACKGROUND

On April 16, 1986, the Indiana Department of Environmental Management (IDEM) requested the EPA to investigate and initiate a removal action at the plant site. The request was made after IDEM representatives observed capacitors disposed of in a ravine and lying on the ground surface adjacent to the plant site. IDEM representatives sampled the oil in the capacitors and reported PCB concentrations in the oil were as high as 100 percent.

On April 19, 1986, EPA representatives conducted an assessment of the site which included a preliminary soil sampling program. The results of the sampling program indicated PCB concentrations, in the soil in the apparent capacitor disposal area, ranged from 325 parts

per million (ppm) to 165,402 ppm. Based on the site assessment, an Administrative Order was issued on June 23, 1986 to Duracell, the former site owner and operator, and to Terra Products Inc., the current site owner. A meeting was held between Duracell and the State on June 26, 1986. Duracell representatives also met with the State and EPA officials on July 7, 1986 to review the Administrative Order and Duracell's proposed work plan. A subsequent survey of the site, initiated by Duracell, indicated the apparent disposal area was located outside the former P.R. Mallory property, on land occupied by Superior Moving.

Duracell submitted a proposed sampling and analysis plan entitled "Work Plan: Initial Site Screening" to the Agencies on July 14, 1986. Approval to proceed with the plan was issued to EPA on July 28, 1986.

On August 20, 1986, an amended Administrative Order was issued which named Superior Moving as a respondent and consequently provided access to the apparent disposal area.

2.3 WORK COMPLETED TO DATE

Preliminary work at the site was initiated prior to issuance of the amended Order to ensure the response

action proceeded in an expeditious manner. All work completed to date has been carried out in accordance with the approved sampling plan and amended Administrative Order.

Construction of a security fence around the former plant site and disposal area began on August 11, 1986. The fence installation was completed on August 28, 1986. A sediment trap constructed of baled hay and an oil absorbent boom were installed in the ravine in conjunction with the installation of the fence. The general site layout is illustrated in Figure 2.2

The preliminary sampling and analysis program was conducted at the plant site by Conestoga-Rovers & Associates (CRA). Samples were collected at the site on August 6, 1986 in accordance with the sampling plan approved by EPA. The results of the sampling program are presented in a report entitled "Initial Site Screening: Sampling Program, Former P.R. Mallory Plant Site, Crawfordsville, Indiana", forwarded to EPA and the State on September 18, 1986.

The sampling and analysis program confirmed the presence of high concentrations of PCBs in the capacitor disposal area. PCB concentrations in the soil ranged from a maximum of 130,000 ppm in the main disposal area to 7,200 ppm adjacent to the incinerator. Concentrations of total dioxin varied from 40.1 ppb in the disposal area to 0.75 ppb in the

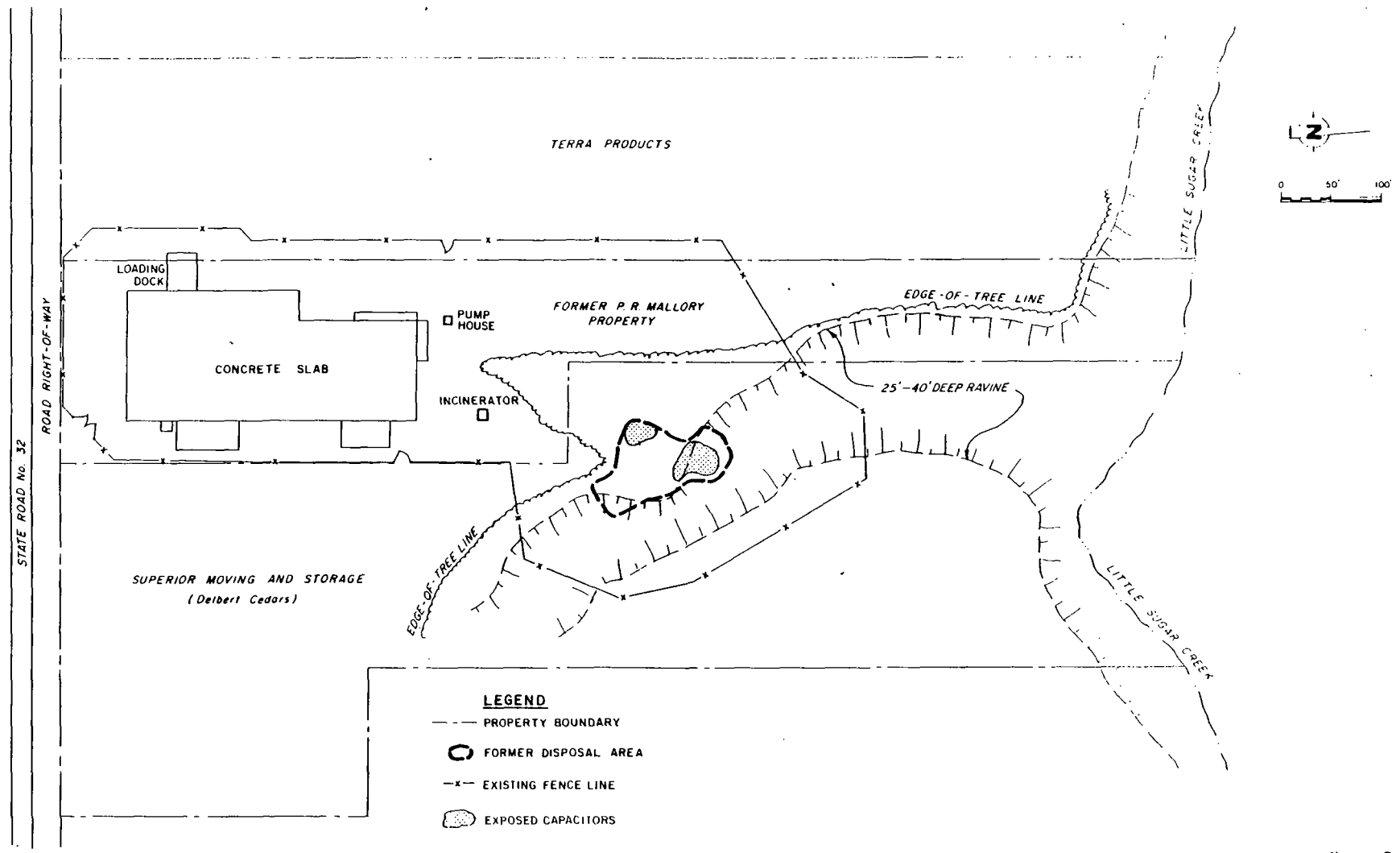


figure 2.2
 EXISTING SITE CONDITIONS
 FORMER P.R. MALLORY PLANT SITE
 Crawfordsville, Indiana

stream bed; dibenzofuran concentrations varied from approximately 1.0 ppm to a maximum concentration of 5.1 ppm detected in the disposal area.

2.4 PROJECT OBJECTIVES

The objectives of the individual components of the proposed site investigation are outlined below.

1. A soil, stream sediment and concrete sampling program will be undertaken to determine the areal and vertical extent of residual contamination at the site following implementation of emergency removal procedures;
2. A hydrogeological investigation will be implemented to determine the impact, if any, of previous site activities on the groundwater regime;
3. A geophysical survey will be initiated to determine the presence, if any, of additional buried disposal areas at the site.

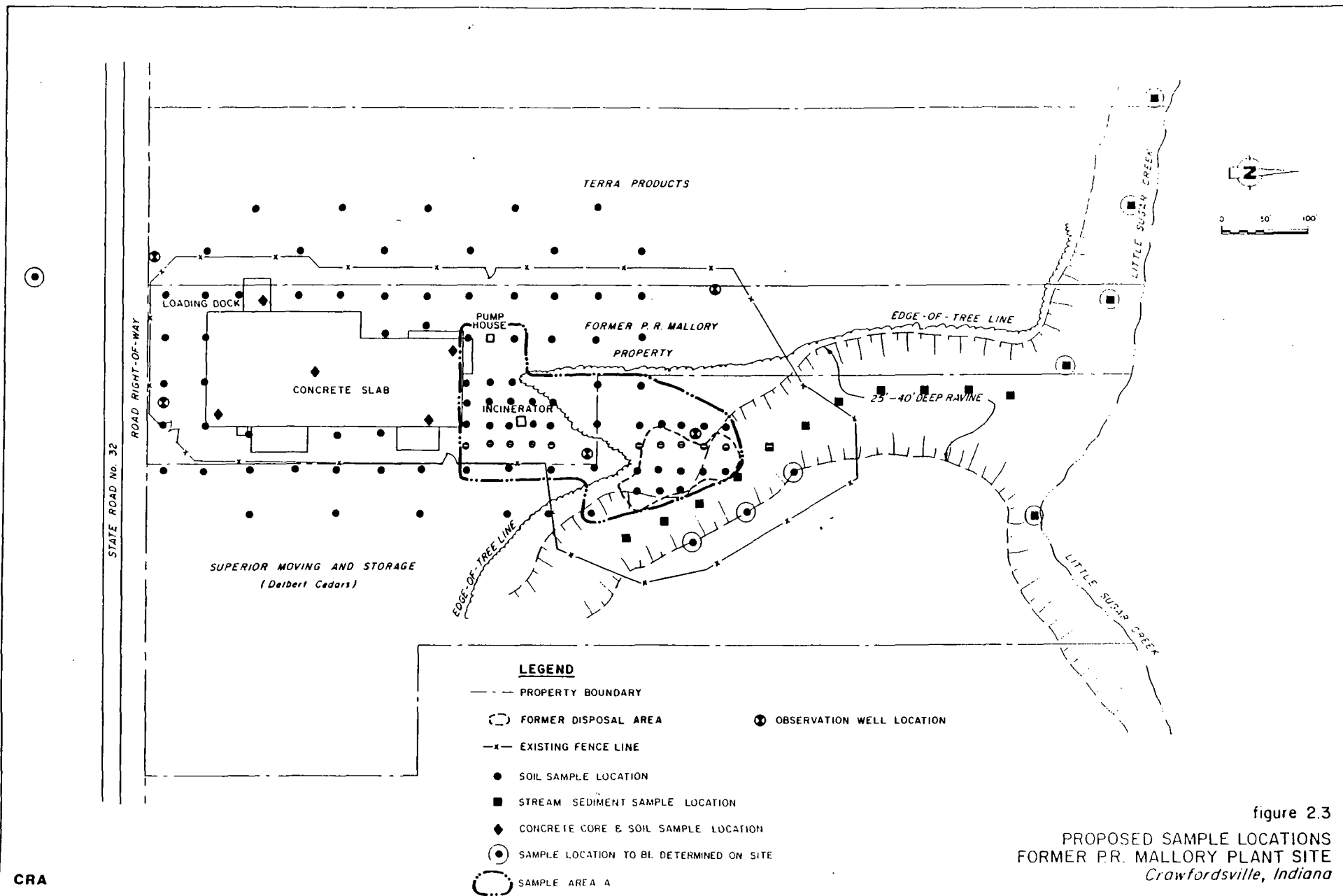
Data gathered during the site investigation will be used to:

- i) identify the quantity and location of remaining residual significant contaminated material;
- ii) characterize the geology at the site and determine the potential pathways of contamination;
- iii) determine the extent and degree of groundwater contamination, if any, and the potential for lateral and vertical migration of contaminants;
- iv) define the scope of work of the Phase II Remedial Construction program; and
- v) determine what additional work, if any, is required to assess the site.

2.5 SAMPLING NETWORK AND LOCATIONS

Proposed sampling and monitoring well locations are illustrated on Figure 2.3. The sampling grid will be expanded and extended, if necessary, to determine the limits of residual soil and stream sediment contamination.

The development of the sampling network and selection of sampling locations is outlined in the site RAWP.



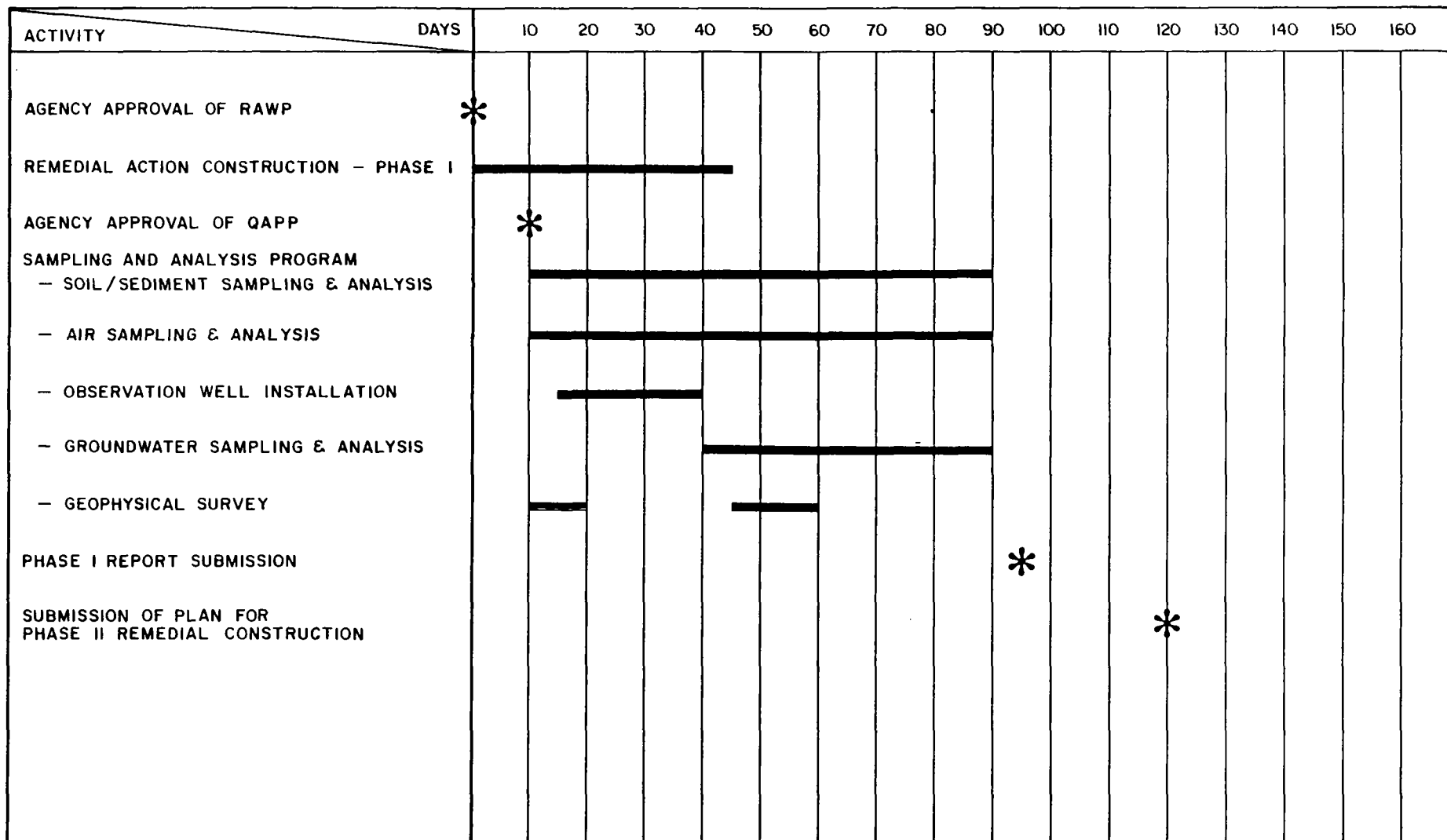
2.6 PROJECT SCHEDULE

The proposed project schedule is illustrated on Figure 2.4. Initiation of the sampling and investigation portion of the RAWP is dependent upon Agency approval of the RAWP and QAPP.

2.7 SAMPLE MATRICES/PARAMETERS/FREQUENCY

The scope of the sampling activities proposed at the site includes the installation of two lower aquifer monitoring wells, five shallow monitoring wells, and the collection and analysis of soil, concrete, stream sediment, ambient air, surface and groundwater samples.

The media/matrices to be sampled include air, surface water, stream sediment, groundwater, soil and concrete core. The sampling and analysis program is summarized in Table 1, which indicates the specific parameters to be measured, the number and frequency of sampling, and the level of QA effort for each environmental media/matrix. Where appropriate, parameters will be quantified in a manner consistent with the intent of the EPA Contract Laboratory Program (CLP) Routine Analytical Services (RAS) protocols as contained in the CLP Statement of Work



* ONE TIME EVENT

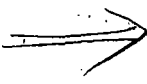
figure 2.4
 PROPOSED SCHEDULE
 FORMER P.R. MALLORY PLANT SITE
Crawfordsville, Indiana

Revision No: 86-0

Date: 11/05/86

Page: 9

(SOW), SOW 985, Modification 10 for organics, SOW 784, Modification 7 for inorganics and the Statement of Work for Dioxin Analysis IFB Am. 1 (12/29/83). Additional water, air, stream sediment and soil quality parameters will be analyzed in accordance with specific EPA standard methods. Elements and compounds to be analyzed in a manner consistent with CLP RAS and the additional water, stream sediment and soil quality parameters to be quantified by specific EPA standard methods are listed in Section 4.3.



WA #6K 357.
Oct 2 1986

TABLE 1

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Revision No.: 86-0

Date: 05/11/86

Page: 9a

Sample Matrix	Field Parameters	Laboratory Parameters	Investigative Samples			QA Samples						Matrix Spike	Total
			No.	Freq.	Total	Duplicate			Blank				
						No.	Freq.	Total	No.	Freq.	Total		
Monitoring Wells ^a													
	pH	VOCs consistent with CLP protocols including up to 10 tentatively identified compounds	7	3	21	1	3	3	3	3	9	3	36
	Specific Conductivity												
	Groundwater Elevations	Total PCBs consistent with CLP protocols	7	3	21	1	3	3	3	3	9	3	36
		Dioxin/Furan consistent with CLP protocols	1	3	3	1	1	1	1	1	1	0	5
		Alkalinity	7	1	7	1	1	1	1	1	1	1	10
		Total Dissolved Solids	7	1	7	1	1	1	1	1	1	1	10
		Sodium	7	1	7	1	1	1	1	1	1	1	10
		Sulfate	7	1	7	1	1	1	1	1	1	1	10
		Chloride	7	1	7	1	1	1	1	1	1	1	10
		Carbonate	7	1	7	1	1	1	1	1	1	1	10
		Bicarbonate	7	1	7	1	1	1	1	1	1	1	10
		Hardness	7	1	7	1	1	1	1	1	1	1	10
		Magnesium	7	1	7	1	1	1	1	1	1	1	10
		Potassium	7	1	7	1	1	1	1	1	1	1	10
		Calcium	7	1	7	1	1	1	1	1	1	1	10

New
SOW.

WA 86K357

Matrix Spike dup.

New
SOW.

WA 86-357

Matrix Spike
dup.

TABLE 1

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Revision No.: 36-0

Date: 05/11/86

Page: 9b

Sample Matrix	Field Parameters	Laboratory Parameters	Investigative Samples			QA Samples						Matrix Spike	Total
			No.	Freq.	Total	Duplicate			Blank				
			No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total		
Surface Water ^b													
	pH	Total PCBs consistent with CLP protocols	11	1	11	1	1	1	1	1	1	1	14
	Specific Conductivity	Dioxin/Furan consistent with CLP protocols	2	1	2	-	-	-	-	-	-		2
	Temperature												
	Dissolved Oxygen												

+
MSP

TABLE 1

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Revision No.: 86-0

Date: 05/11/86

Page: 9c

Sample Matrix	Field Parameters	Laboratory Parameters	Investigative Samples			QA Samples						Matrix Spike	Total
			No.	Freq.	Total	Duplicate			Blank				
			No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total		
✓ Soil/Sediment ^c	Not Applicable	VOCs consistent with CLP protocols including up to 10 tentatively identified compounds	5	1	5	1	1	1	1	1	1	1	8
		BNA extractables consistent with CLP protocols including up to 20 tentatively identified compounds	5	1	5	1	1	1	1	1	1	1	8
		Total PCBs consistent with CLP protocols	121	1	121	12	1	12	12	1	12	6	151
		Dioxin/Furan consistent with CLP protocols	15	1	15	2	1	2	2	1	2		19*

* Refer to the sampling and Analysis Plan (Section A.2.1.2).

TABLE 1

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Revision No.: 86-0

Date: 05/11/86

Page: 9d

Sample Matrix	Field Parameters	Laboratory Parameters	Investigative Samples			QA Samples						Matrix Spike	Total
			No.	Freq.	Total	Duplicate			Blank				
						No.	Freq.	Total	No.	Freq.	Total		
<u>Air</u>													
	Qualitative organic vapor screening with HNu	Total Particulate PCBs consistent with CLP protocols	4	1	4	1	1	1	1	1	1		6
		Total Vaporous PCBs consistent with CLP protocols	4	1	4	1	1	1	1	1	1		6

Notes:

- a Based on sampling and analyses of 7 monitoring wells
 b Based on sampling and analyses of 11 surface water locations
 c Based on sampling of 16 sediment locations

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Conestoga-Rovers & Associates (CRA), has overall responsibilities for all phases of the investigation at the Former P. R. Mallory Plant Site. CRA will perform or supervise all field investigations.

Envirotest Laboratories as subcontractor to CRA will perform all chemical analyses (with the exception of Dioxin/Furan) required as part of the Work Plan. Analyses for Dioxin/Furan will be conducted by Hazleton Laboratories.

All firms will provide project management as appropriate to their responsibilities. CRA will provide administrative oversight and QA/QC for all deliverables. All deliverables will be issued by CRA.

3.1 OPERATIONAL/LABORATORY/QA RESPONSIBILITIES

Figure 3.1 presents the organizational chart for this project. In addition, the functional responsibilities of each of the key technical personnel are summarized below in point form:

R. Shepherd - Project Manager

- preparation and review of final report
- technical representation of project activities
- managerial guidance to technical group
- liaison between technical group and EPA

R. Pyle - Project Coordinator/Quality Assurance Officer -
Field Activities

- arranging site access
- management of field activities and field QA/QC
- system audits - field activities
- data assessment
- overview of field activities
- preparation and review of final report
- technical representation of field activities

P. Plotz - Quality Assurance/Quality Control Coordinator
Project Activities

- system audits - laboratory activities
- co-ordinate supply of performance evaluation samples
- review laboratory QA/QC
- overview of laboratory activities
- decide laboratory data corrective action

- data validation and assessment
- review of tentatively identified compounds
- QA/QC representation of project activities
- preparation and review of Final report

R. Bayer - Envirotest - Project Manager

- coordinate laboratory analyses
- supervise in-house chain-of-custody
- schedule sample analyses
- overview data review
- overview preparation of analytical reports

L. Cercone/R. Cusack - Envirotest - Quality Assurance
Officer Organic/Inorganic

- overview laboratory quality assurance
- overview QA/QC documentation
- conduct detailed data review
- technical representation of laboratory QA procedures

Richard Bayer - Envirotest - Sample Custodian

- receive samples and sign accompanying documents
(chain-of-custody)
- notify technical staff of samples that require immediate
attention
- control and regulate access to samples and log all sample
movements

M. Marks - Hazleton - Project Manager

- coordinate laboratory analyses
- supervise in-house chain-of-custody
- schedule sample analyses
- overview data review
- overview preparation of analytical reports

D. Carly-Arndt - Hazleton - Quality Assurance Officer

- coordinate laboratory analyses
- supervise in-house chain-of-custody
- overview laboratory quality assurance
- schedule sample analyses
- overview QA/QC documentation
- conduct detailed data review
- overview preparation of analytical reports
- technical representation of laboratory QA procedures

M. Marks - Hazleton - Technical Director

- technical representation at meetings
- managerial guidance to technical groups
- technical review of laboratory activities

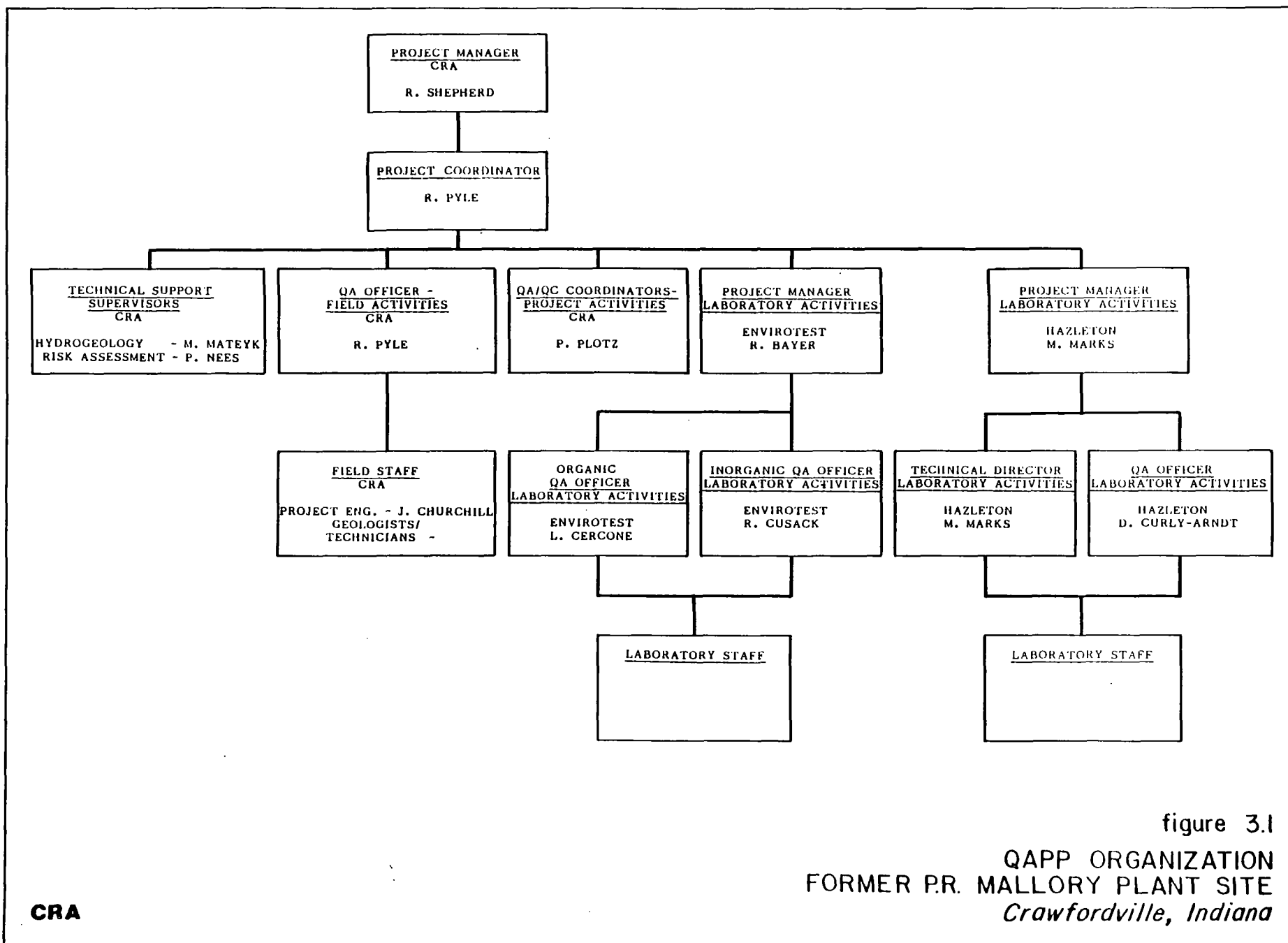
M. Marks - Hazleton - Sample Custodian

- receive samples and sign accompanying documents (chain-of-custody)
- notify technical staff of samples that require immediate attention
- control and regulate access to samples and log all sample movements

Primary responsibility for project quality rests with CRA's QA/QC Coordinator and QA Officer. Ultimate responsibility for project quality rests with CRA's Project Manager. Independent quality assurance is provided by the laboratory Project Managers and QA Officers.

Figures 3.2 and 3.3 present data flow charts for Envirotest and Hazleton respectively.

Data Review?



4.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

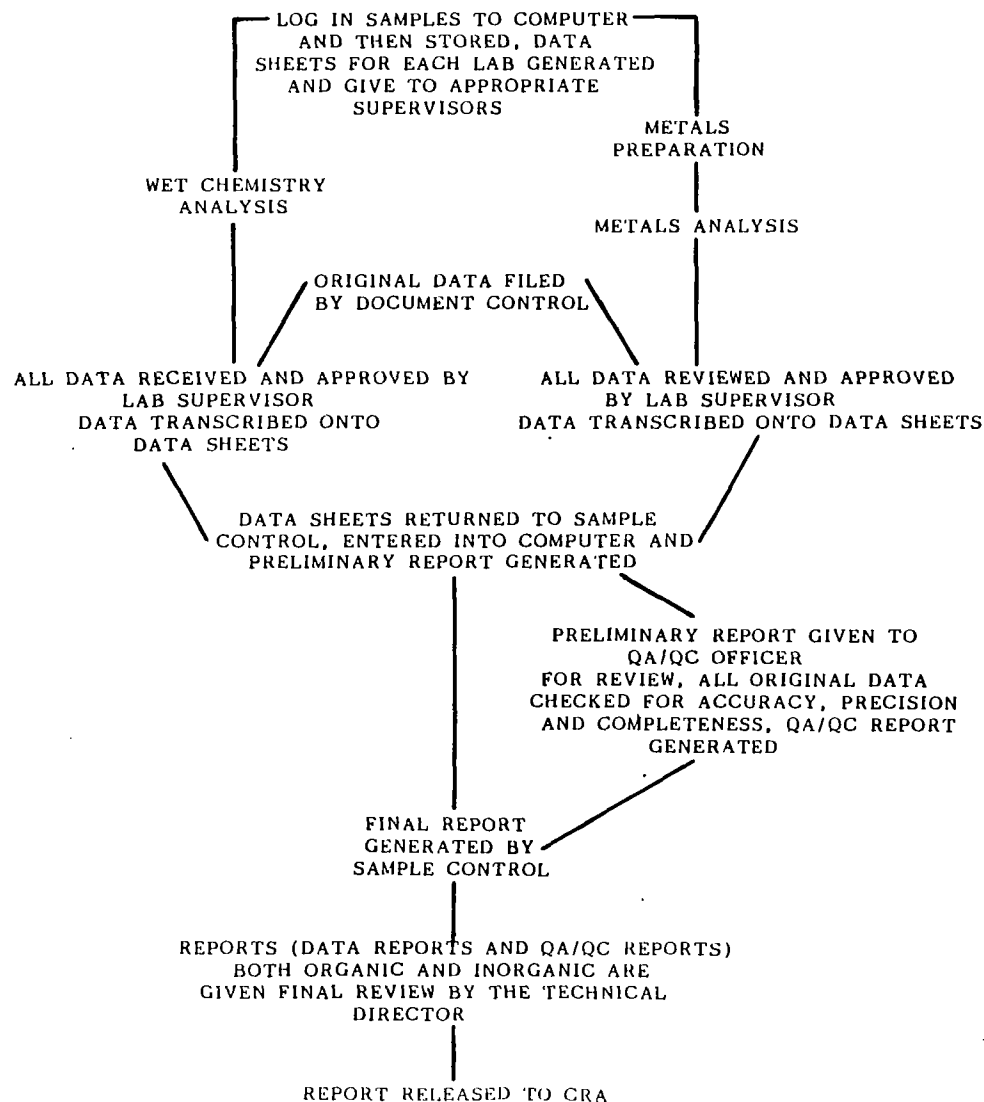
The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis and reporting that will provide accurate data for the investigative sampling. Specific procedures to be used for sampling, chain-of-custody, calibration, laboratory analysis, reporting, quality control, audits, preventative maintenance and corrective actions are presented in other sections of this QAPP.

The purpose of this section is to define the goals for the level of QA effort; accuracy, precision and sensitivity of analyses; and completeness, representativeness, and comparability of measurement data from the analytical laboratories. QA objectives for field measurements are also discussed.

4.1 DETECTION LIMIT REQUIREMENTS

The data used to conduct the response action should have method detection limits that are consistent with the objectives of the CLP RAS and appropriate EPA standard methods.

INORGANIC
SAMPLE CONTROL/RECEIVING



ORGANIC
SAMPLE CONTROL/RECEIVING

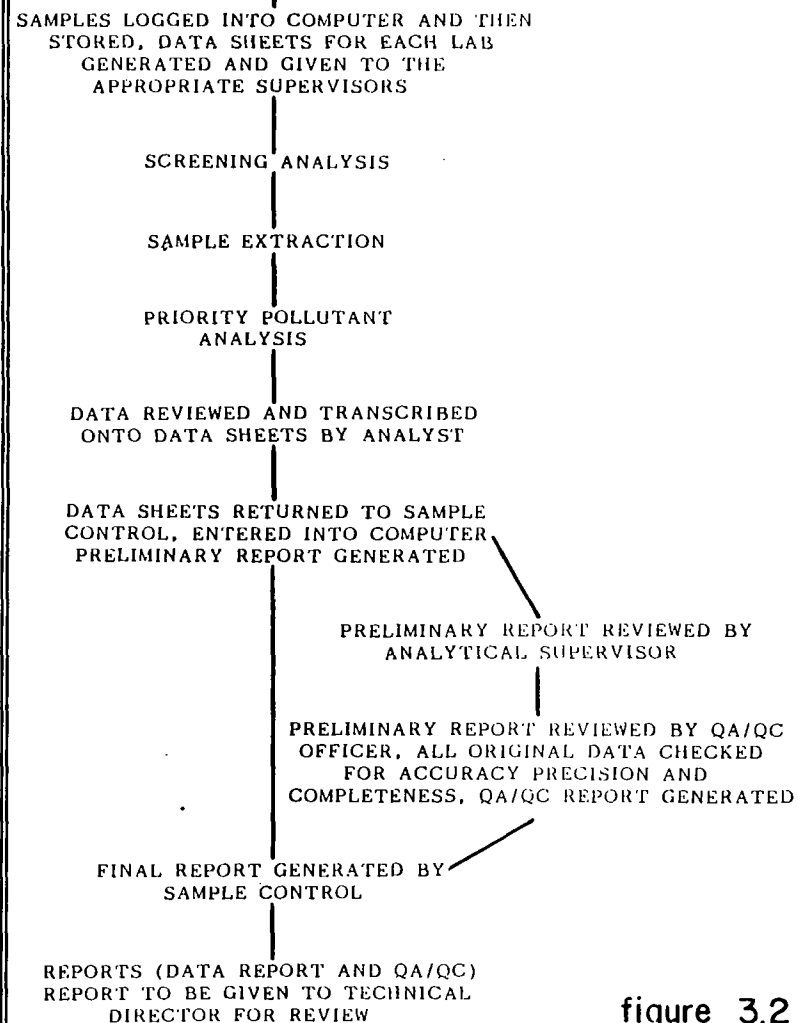


figure 3.2

DATA FLOW CHART
ENVIROTEST LABORATORIES
FORMER P.R. MALLORY PLANT SITE
Crawfordville, Indiana

CRA

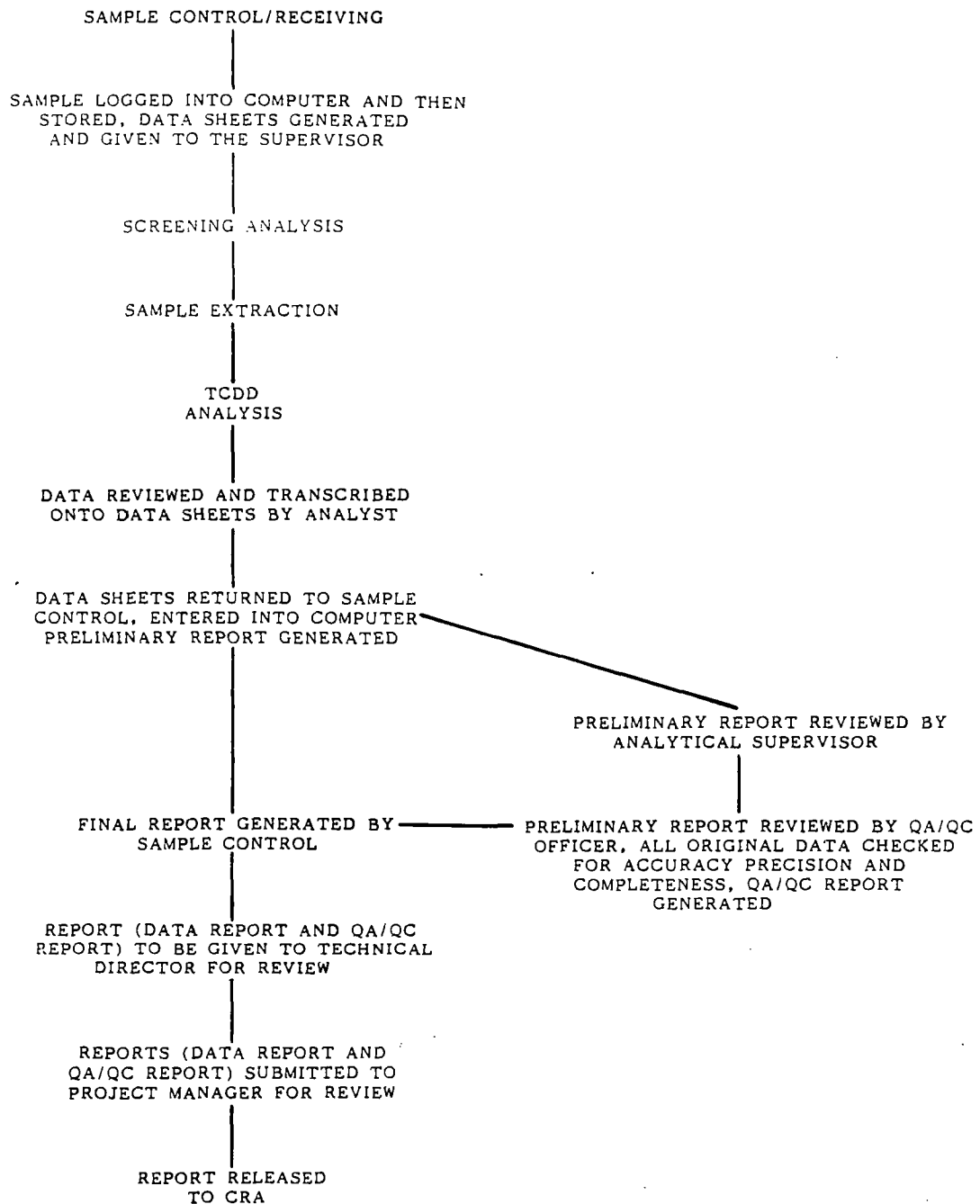


figure 3.3

DATA FLOW CHART
HAZLETON LABORATORIES
FORMER P.R. MALLORY PLANT SITE
Crawfordville, Indiana

CRA

The target detection limits for chemical analyses are presented in Section 4.3.

These detection limits will be reported using protocols established in 40 CFR Part 136, Appendix B, October 26, 1984. Verification of the lower detection limit attainment will be achieved by sensitivity checks of the equipment using standards at concentrations of twice the targeted detection limit. The standards will be run prior to analysis of any samples for the project and weekly or following recalibration of equipment throughout project analytical activities.

4.2 LEVEL OF QA EFFORT

To assess the quality of data resulting from the field sampling program, field duplicate, field blank (rinsate), and duplicate matrix spike samples will be taken → and submitted to the analytical laboratories.

For well samples, field duplicate samples will be submitted at a frequency of one per ten (10) investigative samples. Field blank samples will be collected and submitted at a frequency of one per ten (10) well

purging/sampling equipment cleanings.

Field blank frequency and preparation would be consistent with the method of collection of field blanks from well samples. Field duplicate samples will be collected at a frequency of one per each matrix of surface water, and sediment. Field duplicate for soil samples will be collected at a frequency of one per ten (10) sampling locations.

Samples for duplicate matrix spike analysis will be collected at a frequency of one per 20 investigative samples and in volumes as outlined in the sampling plan.

Field blank samples will be analyzed to check procedural contamination and/or ambient conditions and/or sample container contamination at the site that may cause sample contamination. Field duplicate samples will be analyzed to check for sampling and analytical reproducibility. Laboratory matrix spike samples will be

analyzed in duplicate at the same spike levels to check for analytical precision and reproducibility. The specific level of field QA effort for this sampling program, itemized by sample matrix and parameter, is summarized in Table 1.

Where appropriate, surface water, stream sediment, surface wipe, air, soil and groundwater samples collected at the site will be analyzed in a manner consistent with CLP RAS protocols. The level of laboratory QA effort for the samples analyzed in a manner consistent with the intent of CLP RAS protocols is specified in the appropriate CLP Statement of Work (SOW), SOW 985, Modification 10 for organics, SOW 784, Modification 7 for inorganics and Statement of Work for Dioxin Analysis, IFB AM.1 (12/29/83) for TCDD.

During the first sampling round, all groundwater samples will be analyzed for additional water quality parameters. The methods to be employed for these parameters are summarized in Table 4. The level of laboratory QA effort for the additional water quality parameters is summarized on Table 2. The methods to be employed for Dioxin/Furan are summarized in Table 4. The level of laboratory QA effort for Dioxin/Furan will involve analysis of one preparation blank (liquid) at the time of analysis of investigative samples.

4.3 ACCURACY, PRECISION AND SENSITIVITY OF ANALYSES

The fundamental QA objective with respect to accuracy, precision, and sensitivity of laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols. The accuracy and precision requirements for samples analyzed in a manner consistent with the CLP RAS protocols are specified in the appropriate CLP SOWs discussed in Section 4.2. The sensitivities required for these organic and inorganic analyses will be the target detection limits listed in Tables 3 and 4, respectively while the methods to be employed for the organic parameters are outlined in Table A-2 of Appendix A.

The accuracy and precision requirements for the additional water, stream sediment and soil quality parameters will be in accordance with their specified EPA methods. Table 4 lists the analytical method references and sensitivities required for the additional water, and soil quality parameters.

4.4 COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

It is expected that organics, inorganics and Dioxin/Furan analyzed in a manner consistent with CLP protocols will provide data meeting QC acceptance criteria

TABLE 2

QUALITY CONTROL PROCEDURES FOR ADDITIONAL WATER LABORATORY ANALYSES

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<u>Parameters</u>	<u>Lab Blanks</u>	<u>Lab Duplicates</u>	<u>Quality Control Check Samples</u>
Alkalinity	One per set of samples	One per set of samples or a minimum of 1 in 10	One per set of samples
Bicarbonate	One per set of samples	One per set of samples or a minimum of 1 in 10	One per set of samples
Carbonate	One per set of samples	One per set of samples or a minimum of 1 in 10	One per set of samples
Magnesium	One per set of samples	One per set of samples or a minimum of 1 in 10	One per set of samples
Potassium	One per set of samples	One per set of samples or a minimum of 1 in 10	One per set of samples
Total Dissolved Solids (TDS)	One per set of samples	One per set of samples or a minimum of 1 in 10	One per set of samples
Hardness	One per set of samples	One per set of samples or a minimum of 1 in 10	One per set of samples
Sulfate	One per set of samples	One per set of samples or a minimum of 1 in 10	One per set of samples
Chloride	One per set of samples	One per set of samples or a minimum of 1 in 10	One per set of samples
Sodium	One per set of samples	One per set of samples or a minimum of 1 in 10	One per set of samples
Calcium	One per set of samples	One per set of samples minimum of 1 in 10	One per set of samples

for 95 percent of all samples tested. Completely valid data for additional water, air, stream sediment and soil quality parameters and physical parameters should be provided, and the reasons for any variances from 100 percent completeness will be documented.

The sampling network was designed to provide data representative of site conditions. During development of this network, consideration was given to past disposal practices, existing analytical data, remedial activities to date and physical setting. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data are documented in this QAPP. It may be necessary to verify similar documentation for existing analytical data. Following completion of data collection, the existing data base will be evaluated for representativeness.

4.5 FIELD MEASUREMENTS

Measurement data will be generated in many field activities. These activities include, but are not limited to, the following:

TARGETED DETECTION LIMITS FOR ORGANIC ANALYSES

VOLATILE COMPOUNDS

Targeted Detection Limits**

<u>CAS No.</u>	<u>Compound</u>	<u>Water</u> (ug/L)	<u>Soil/Sediment</u> (ug/kg)
74-87-3	chloromethane	1	1
74-83-9	bromomethane	1	1
75-01-4	vinyl chloride	1	1
75-00-3	chloroethane	1	1
75-09-2	methylene chloride	1	1
75-35-4	1,1-dichloroethene	1	1
75-35-3	1,1-dichloroethane	1	1
156-60-5	trans-1,2-dichloroethene	1	1
67-66-3	chloroform	1	1
107-06-2	1,2-dichloroethane	1	1
71-55-6	1,1,1-trichloroethane	1	1
56-23-5	carbon tetrachloride	1	1
75-27-4	bromodichloromethane	1	1
78-87-5	1,2-dichloropropane	1	1
10061-02-6	trans-1,3-dichloropropene	1	1
71-01-6	trichloroethene	1	1
71-43-2	benzene	1	1
124-48-1	dibromochloromethane	1	1
79-00-5	1,1,2-trichloroethane	1	1
10061-01-05	cis-1,3-dichloropropene	1	1
110-75-8	2-chloroethylvinyl ether	1	1
75-25-2	bromoform	1	1
127-18-4	tetrachloroethene	1	1
79-34-5	1,1,2,2-tetrachloroethane	1	1
108-88-3	toluene	1	1
108-90-7	chlorobenzene	1	1
100-41-4	ethylbenzene	1	1

Styrene
Total Reflux

5x210x ↓ than
cup.

TABLE 3

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TARGETED DETECTION LIMITS FOR ORGANIC ANALYSESBASE/NEUTRAL/ACID COMPOUNDS

<u>CAS No.</u>	<u>Compound</u>	<u>Targeted Detection Limits**</u>	
		<u>Water</u> <u>(ug/L)</u>	<u>Soil/Sediment</u> <u>(ug/kg)</u>
62-75-9	N-nitrosodimethylamine	1	1
111-44-4	bis(2-chloroethyl) ether	1	1
108-95-2	phenol	10	10
95-57-8	2-chlorophenol	10	10
541-73-1	1,3-dichlorobenzene	1	1
106-46-7	1,4-dichlorobenzene	1	1
95-50-1	1,2-dichlorobenzene	1	1
39638-32-9	bis (2-chloroisopropyl) ether	1	1
67-72-1	hexachloroethane	1	1
621-64-7	N-nitrosodi-dipropylamine	1	1
98-95-3	nitrobenzene	1	1
78-59-1	isophorone	1	1
88-75-5	2-nitrophenol	10	10
105-67-9	2,4-dimethylphenol	10	10
111-91-1	bis (2-chloroethoxy) methane	1	1
120-83-2	2,4-dichlorophenol	10	10
120-82-1	1,2,4-trichlorobenzene	1	1
91-20-3	naphthalene	1	1
87-68-3	hexachlorobutadiene	1	1
59-50-7	4-chloro-3-methyl phenol	10	10
77-47-4	hexachlorocyclopentadiene	1	1
88-06-2	2,4,6-trichlorophenol	10	10
91-58-7	2-chloronaphthalene	1	1
208-96-8	acenaphthylene	1	1
131-11-3	dimethyl phthalate	1	1
606-20-2	2,6-dinitrotoluene	1	1
83-32-9	acenaphthene	1	1
51-28-5	2,4-dinitrophenol	25	25
121-14-2	2,4-dinitrotoluene	1	1
86-73-7	fluorene	1	1
100-02-7	4-nitrophenol	10	10
7005-72-3	4-chlorophenyl phenyl ether	1	1

TABLE 3

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TARGETED DETECTION LIMITS FOR ORGANIC ANALYSESBASE/NEUTRAL/ACID COMPOUNDS (Cont'd)

<u>CAS No.</u>	<u>Compound</u>	<u>Targeted Detection Limits**</u>	
		<u>Water</u> <u>(ug/L)</u>	<u>Soil/Sediment</u> <u>(ug/kg)</u>
84-66-2	diethyl phthalate	1	1
534-52-1	4,6-dinitro-2-methylphenol	25	25
86-30-6	N-nitrosodiphenylamine (diphenylamine)	1	1
101-55-3	4-bromophenyl phenyl ether	1	1
118-74-1	hexachlorobenzene	1	1
87-86-5	pentachlorophenol	10	10
85-01-8	phenanthrene	1	1
120-12-7	anthracene	1	1
84-74-2	di-n-butyl phthalate	1	1
206-44-0	fluoranthene	1	1
129-00-0	pyrene	1	1
85-68-7	butyl benzyl phthalate	1	1
218-01-9	chrysene	1	1
56-55-3	benzo(a)anthracene	1	1
117-81-7	bis (2-ethylhexyl) phthalate	1	1
117-84-0	di-n-octyl phthalate	1	1
205-99-2	benzo(b)fluoranthene	1	1
207-08-9	benzo(k)fluoranthene	1	1
50-32-8	benzo(a)pyrene	1	1
193-39-5	indeno(1,2,3-cd)pyrene	1	1
53-70-3	dibenz(a,h)anthracene	1	1
191-24-2	benzo(g,h,i)perylene	1	1
92-87-5	benzidine	1	1
91-94-1	3,3'-dichlorobenzidine	1	1
88-74-4	2-nitroaniline	1	1
122-66-7	1,2-diphenylhydrazine	1	1
1746-01-6	2,3,7,8-tetrachlorodibenzo-p-dioxin	1	1

TABLE 3

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TARGETED DETECTION LIMITS FOR ORGANIC ANALYSESPCBs

<u>CAS No.</u>	<u>Compound</u>	<u>Targeted Detection Limits**</u>	
		<u>Water (ug/L)</u>	<u>Soil/Sediment (ug/kg)</u>
12674-11-2	aroclor 1016	0.1	100
11104-28-2	aroclor 1221	0.1	100
11141-16-5	aroclor 1232	0.1	100
53469-21-9	aroclor 1242	0.1	100
12672-29-6	aroclor 1248	0.1	100
11097-69-1	aroclor 1254	0.1	100
11096-82-5	aroclor 1260	0.1	100

5 ~ 10% lower.

** Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, as required by the contract, will be higher.

***Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable.

TABLE 4
 ANALYTICAL METHODS FOR ADDITIONAL WATER
 AND SOIL QUALITY PARAMETERS

<u>Parameter</u>	<u>Method Reference</u>	<u>Targeted * Detection Limits</u>
<u>Water d</u>		
Alkalinity	310 ^b	2.0 mg/L
Bicarbonate	310 ^b	2.0 mg/L
Carbonate	310 ^b	2.0 mg/L
Hardness	130 ^b	2.0 mg/L
Sulfate	375 ^b	10.0 mg/L
Chloride	325 ^b	2.0 mg/L
Magnesium	242 ^b	0.5 mg/L
Potassium	251 ^b	1.0 mg/L
Sodium	375 ^b	1.0 mg/L
Total Dissolved Solids (TDS)	160 ^b	1.0 mg/L
<u>Soil/Sediment</u>		
Dioxin/Furan	8280 ^a ✓	2.0 ug/kg
<u>Water</u>		
Dioxin/Furan	8280 ^a ✓	20 ng/L

* Specific detection limits are highly matrix dependent.
 The detection limits listed herein are provided as a
 guideline and may not always be achievable.

not
consistent

TABLE 4

ANALYTICAL METHODS FOR ADDITIONAL WATER, LEACHATE
AND SOIL QUALITY PARAMETERS

NOTES:

- a = Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846, 2nd Ed), 1984
- b = Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, Revised March 1983
- c = Standard Methods for the Examination of Water and Wastewater, 15th Edition, APHA, 1980
- d = Monitoring wells and surface water
- e = Analysis consistent with CLP SOW for Dioxin Analysis using EPA 613 water extraction procedure instead of CLP SOW jar extraction procedure

- . Documenting time and weather conditions.
- . Determining pH, specific conductivity, and temperature of water samples.
- . Determining depths in a borehole or well.
- . Verifying well development and pre-sampling purge volumes.
- . Performing well recovery tests.
- . Recording blow counts during well installation and sampling.
- . Observation of drill cuttings, sample appearance, and other conditions.
- . Visual classification of soil boring samples.
- . Measuring groundwater elevations in wells.
- . Determining horizontal location and elevation of sample locations.

The general QA objective for such measurement data is to obtain reproducible and comparable measurements to a degree of accuracy consistent with the intended use of the data through the documented use of standardized procedures. The procedures for performing these activities and the standardized formats for documenting them are presented in the Sampling and Analysis Plan (Appendix A) and the Observation Well Installation Protocols (Appendix B).

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5.0 SAMPLING PROCEDURES

The procedures for collecting samples and for performing all related field activities are described in detail in the Sampling and Analysis Plan (Appendix A).

6.0 SAMPLE CUSTODY

Sample custody protocols for this investigation will be consistent with standard CRA procedures as follows. All samples will be in the custody of a responsible person and a record will be completed of those in custody of the samples via a field chain-of-custody form. The chain-of-custody form consists of four copies which are distributed to the sampler, the receiving laboratory, the CRA laboratory, and the CRA office file. The sampler will maintain his copy while the other three copies are enclosed within the cooler with the samples in a waterproof envelope. The laboratory upon receiving the samples will complete the three remaining copies and forward two to CRA. The laboratory will maintain one copy for their records and initiation of laboratory chain-of-custody procedures. Field custody procedures are further described in the Sampling and Analysis Plan (Appendix A).

Laboratory custody procedures and document control for those samples analyzed in a manner consistent with CLP RAS protocols will be carried out as specified in the appropriate CLP SOWs. Laboratory custody procedures for the additional water quality parameters will also be consistent with the CLP SOWs for organics and inorganics.

Document control will be as follows. All observations and results recorded by the laboratory but not on preprinted data sheets are entered into permanent logbooks specific to the project. All documents relevant to the work, including logbooks, chart recordings, custody records, correspondence, etc., will be inventoried and assembled in a permanent file for submittal to CRA.

Data files for the entire project shall be inventoried and maintained by CRA and shall consist of the following:

- A Project Plan
- B Project Logbooks
- C Field Data Records
- D Sample Identification Documents
- E Chain-of-Custody Records
- F Analytical Reports, etc.
- G Correspondence
- H References, Literature
- I Sample (on-hand) Inventory
- J Miscellaneous - photos, maps, drawings, etc.
- K Final Report

The data file materials shall be the responsibility of the project coordinator with respect to maintenance and document removal.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

The calibration procedures and frequency of calibration for samples analyzed in a manner consistent with CLP RAS protocols are specified in the CLP SOWs for organics, inorganics and TCDD. Calibration procedures and frequency for analytical services for the additional water, stream sediment and soil quality parameters will be in accordance with their individual specified EPA standard method.

Calibration of the field instruments will be done prior to the collection of each water sample. The field equipment will be maintained, calibrated and operated in a manner consistent with the manufacturer's guidelines and EPA standard methods. (Appendix A, Attachment 1).

8.0 ANALYTICAL PROCEDURES

All surface water, sediment, air, soil and groundwater samples collected for chemical analysis will be tested for the parameters outlined in Tables 3 and 4 in a manner consistent with CLP RAS protocols. The methods for performing these analyses are specified in the appropriate CLP SOWs for organics and inorganics. The testing will also conform to the guidelines in the "User's Guide to the U.S. EPA Contract Laboratory Program, Revised July 1984". The analytical results for parameters in soil and sediment will be reported on a dry weight basis.

Groundwater samples collected will be tested for additional organic and inorganic parameters in accordance with the analytical methods listed in Table 4.

Ten percent of all soil and sediment samples collected will also be analyzed for Dioxin/Furan in accordance with the CLP SOW analytical method and appropriate modifications as described in Table 4.

The procedures for field measurement of pH, specific conductivity and temperature of water of samples are discussed in the Sampling and Analysis Plan (Appendix A).

9.0 DATA REDUCTION, VALIDATION, ASSESSMENT,
AND REPORTING

Envirotest and Hazleton will perform analytical data reduction and validation in-house under the direction of the laboratory QA officer. The laboratory QA officers are responsible for assessing data quality and advising of any data which were rated "preliminary" or "unacceptable" or other notations which would caution the data user of possible unreliability. Data reduction, validation, and reporting by the laboratory will be conducted as follows:

- Raw data produced by the analyst is turned over to the respective area supervisor.
- The area supervisor reviews the data for attainment of quality control criteria as outlined in CLP protocols and established EPA methods and for overall reasonableness.
- Upon acceptance of the raw data by the area supervisor, a computerized report is generated and sent to the laboratory quality assurance officer.
- The laboratory quality assurance officer will complete a thorough audit of reports at a frequency of one in ten, and an audit of every report for consistency.

- The QA officer and area supervisor will decide whether any sample re-analysis is required.
- Upon acceptance of the preliminary reports by the QA officer, final reports are generated and signed by the laboratory project manager. The laboratory package shall be presented in the same order as which the samples were analyzed.

CRA's QA/QC coordinator will conduct an evaluation of data reduction and reporting by the laboratory. These evaluations will consider the finished data sheets, calculation sheets, document control forms, blank data, duplicate data, and recovery data for matrix and surrogate spikes. The material will be checked for legibility, completeness, correctness, and the presence of necessary dates, initials, and signatures. The results of these checks will be assessed and reported to the project manager noting any discrepancies and their effect upon acceptability of the data.

Validation of the ^{of CRA?} analytical data will be performed by the QA/QC coordinator in accordance with the U.S. EPA laboratory Data Validation -Functional Guidelines for Evaluating Organics Analyses. Assessment of analytical and in-house data will also include checks for data

data consistency by looking for comparability of duplicate analyses, comparability to previous data from the same sampling location (if available), adherence to accuracy and precision criteria, transmittal errors, and anomalously high or low parameter values. The results of these data validations will be reported to the project manager, noting any discrepancies and their effect upon acceptability of the data. Additional reporting is described in Section 14.0.

Raw data from field measurements and sample collection activities that are used in project reports will be appropriately identified and appended to the final report. Where data have been reduced or summarized, the method of reduction will be documented in the report.

10.0 INTERNAL QUALITY CONTROL PROCEDURES

Internal quality control procedures for samples analyzed in a manner consistent with CLP RAS protocols will be in accordance with those specified in the appropriate CLP SOWs. These specifications include the types of audits required (sample spikes, surrogate spikes, reference samples, controls, blanks), the frequency of each audit, the compounds to be used for sample spikes and surrogate spikes, and the quality control acceptance criteria for these audits.

Internal quality control procedures for analytical services for the additional water, stream sediment and soil quality parameters will be in accordance with their individual specified EPA standard method and standard laboratory operating procedures.

Quality control procedures for field measurements are limited to checking the reproducibility of the measurement in the field by obtaining multiple reading and/or by calibrating the instruments (where appropriate).

Quality control of field sampling will involve collecting field duplicates and field blanks in accordance with the applicable procedures described in the Sampling and Analysis Plan (Appendix A) and the level of effort indicated in Table 1.

11.0 PERFORMANCE AND SYSTEMS AUDITS

CRA's Project Manager will monitor and audit the performance of QA/QC procedures to ensure that the project is executed in accordance with this QAPP.

Laboratory

An informed audit of Envirotest will be executed by CRA's QA/QC Co-ordinator. Hazleton Laboratories America Inc. has been audited periodically by CRA over the previous year and; will not be audited again for this project.

Not acceptable for EPA Region 5 Standard

Field

CRA's Project Co-ordinator will schedule two systems audits of the sampling and monitoring-well installation activities to ensure that the Sampling Plan is being adhered to and/or that variances are justified and documented. These audits will be scheduled to allow oversight of as many different field activities as possible, and will be performed by CRA's QA Officer for field activities.

12.0 PREVENTIVE MAINTENANCE

This section applies solely to field equipment. For this project, this includes a field pH meter, HACH kit for Dissolved Oxygen, and a YSI specific conductance and temperature meter. Specific preventive maintenance procedures for this equipment will be consistent with the manufacturer's guidelines and EPA Standard Methods (Appendix A, Attachment 1).

13.0 CORRECTIVE ACTION PROCEDURES

Corrective action indicated by audit results or detection of unacceptable data will be determined by CRA's Project Co-ordinator in consultation with the Agencies involved. Corrective action may include, but is not limited to:

- . reanalyzing the samples, if holding time criteria permit
- . resampling and analyzing
- . evaluating and amending sampling and analytical procedures
- . accepting data with an acknowledged level of uncertainty.
- . discarding the data.

The type of corrective action required will be outlined in a proposal by the QA/QC co-ordinator and the QA officer for field activities in consultation with the Project Manager. The proposed corrective action will be discussed with The Agencies prior to implementation of any corrective action. A particular corrective action alternative will be implemented only after full agreement to the type of action required by the Agencies.

14.0 QA REPORTS

The final report will contain a discussion on QA/QC summarizing the quality of the data collected and/or used as appropriate to each phase of the project.

Detailed reports of QA activities will be prepared and submitted to the U.S. EPA, Region V, Central Regional Laboratory and the U.S. EPA project officer and will include:

1. Report from the laboratory project managers of data reduction.
2. Report from the CRA QA/QC coordinator of data validation.
3. Report from the CRA QA officer on field audits.
4. Results from performance evaluation samples supplied by U.S. EPA.
5. Laboratory documentation for review purposes including:
 - Sample Data Summary Package
 - Chain of Custody Package
 - QC Sample Data Summary

These documents shall be submitted to the EPA Central Regional Laboratory following receipt and review by CRA's QA/QC Co-ordinator.

REFERENCES

Camp Dresser & McKee. "Quality Assurance Project Plan, Remedial Investigation/Feasibility Study, Pristine, Inc.; Reading, Ohio".

CH2M Hill. "Quality Assurance Project Plan (QAPP) Phase III Remedial Investigation, Wauconda Sand and Gravel, (Draft), EPA No: 29-5M81.0.

"Preparation of Federal-Lead Remedial Investigation Quality Assurance Project Plans for Region V, December 20, 1985". Quality Assurance Office, U.S. EPA.

"Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (QAM-005/80)". Office of Monitoring Systems and Quality Assurance Office of Research and Development, U.S. EPA.

"Users Guide to the Contract Laboratory Program, October 1984". Office of Emergency and Remedial Response, U.S. EPA.

"Contract Laboratory Program, Statement of Work (SOW), Inorganic Analysis, Multi-Media, Multi-Concentration, SOW 784", Med. 7". U.S. EPA.

"Contract Laboratory Program, Statement of Work (SOW), Organic Analysis, Multi-Media, Multi-Concentration, SOW 985', Med. 10". U.S. EPA.

"Statement of Work, Dioxin Analysis, Soil/Sediment Matrix, Multi-Concentration, Selected Ion Monitoring (SIM) GC/MS Analysis with Ion Extraction Procedure" U.S. EPA IFB AM.1 12/29/83.

→ "NEIC Policies and Procedures (EPA-330/9-78-001-R)" May 1978 (Revised ~~February 1983~~), National Enforcement Investigations Center, U.S. EPA. *June, 1986*

"Laboratory Data Validation, Functional Guidelines for Evaluating Organics Analyses, Technical Directive Document No. HQ-8410-01, Contract No. 68-01-6699" U.S. EPA, April 11, 1985.

"Laboratory Data Validation, Functional Guidelines for Evaluating Inorganics Analyses, "Review of Contractor Data from the IFB WA84-A002 Chemical Analytical Services for 2,3,7,8-Tetrachloro-dibenzo-p-dioxin" U.S. EPA, March 15, 1985.

Conestoga-Rovers & Associates "Quality Assurance Project Plan, Supplemental Remedial Investigation/Feasibility Study, Wauconda Sand and Gravel Landfill Site; Wauconda, Illinois".

APPENDIX A

SAMPLING AND ANALYSIS PLAN

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A.1 INTRODUCTION

The sampling and analysis plan at the former P.R. Mallory Plant site in Crawfordsville, Indiana will include the collection of surface and subsurface soil samples; stream sediment samples; surface water samples; ambient air samples; groundwater samples; and surface wipe samples from decontaminated debris.

Samples to be collected are intended for chemical analysis to define areas of residual contamination requiring further remediation. Wipe samples will be taken to confirm the effectiveness of the decontamination procedures for miscellaneous debris. Therefore, it is imperative that all sampling protocols be strictly followed to eliminate any possible cross-contamination between samples or to prevent any other bias in the field sampling.

Sampling activities may involve contact with potentially contaminated soils or material. Therefore, all sampling activities shall be carried out in strict accordance with the approved Project Health and Safety Plan outlined in Appendix A of the Response Action Work Plan.

A.2 SOIL SAMPLING

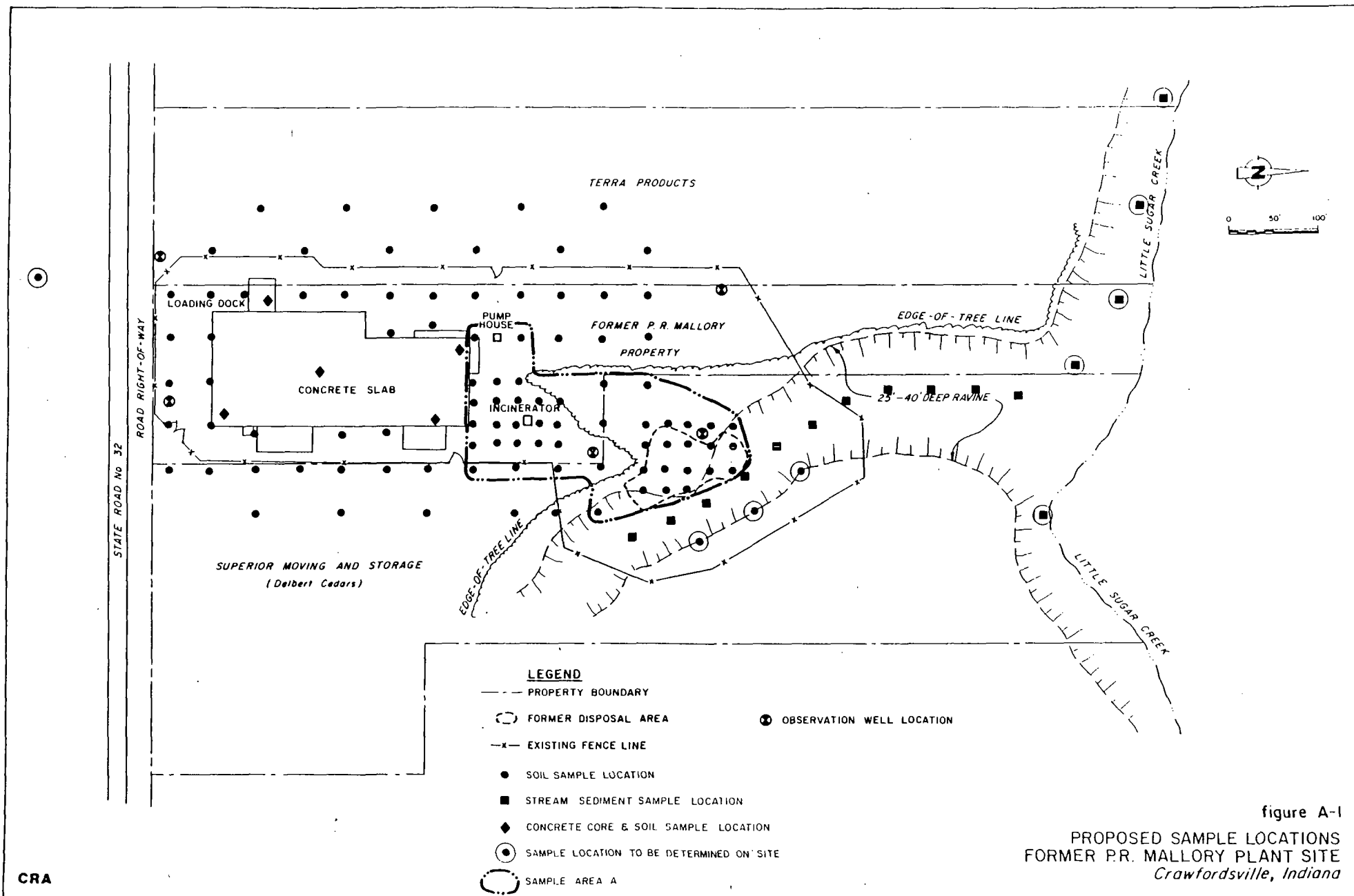
Soil sampling shall be carried out in accordance with the sampling protocols contained herein. Sampling locations are indicated on Figure A-1 and the number of samples to be collected is summarized on Table A-1.

A.2.1 SAMPLE PREPARATION AND HANDLING

A.2.1.1 Equipment Decontamination

All sampling equipment which may come in contact with potentially contaminated materials shall be decontaminated prior to field use and after each sample is collected to prevent cross-contamination of the soil samples. Duplicate samples shall be collected concurrently with original samples, therefore, sampling equipment will not be decontaminated before collection of the duplicate. Decontamination of equipment will be performed as follows:

1. clean water wash to remove all visible foreign matter;
2. rinse with deionized water;
3. rinse with reagent-grade acetone;
4. rinse with 1,1,1-trichloroethane; and
5. air dry on clean plastic sheet.



CRA

TABLE A-1

SUMMARY OF FIELD SAMPLES
FORMER P.R. MALLORY PLANT SITE, CRAWFORDSVILLE, INDIANA

<u>Sample Type</u>	<u>Number of Samples</u>	<u>Trip Blanks</u>	<u>Field Blanks</u>	<u>Blind Duplicates</u>	<u>Matrix Spike</u>	<u>Total</u>
Groundwater (per round)	7	2	1	1	1	12
Surface Water	11	-	1	1	1	14
Ambient Air	8	-	2	2		12
Soil/Sediment	121	-	12	12		145
Concrete	5	-	1	-		6
Surface Wipe	30	-	1	2		33

*routine
air sampling?*

Fluids used for cleaning shall not be recycled. All wash water, rinse water and decontamination fluids shall be stored in containers on site as outlined in Section A.2.1.6

A.2.1.2 Soil Sample Collection

A split spoon sampler shall be used to retrieve soil and sediment sample, as outlined below:

1. A new pair of disposable gloves will be used at each sampling location and for the preparation of samples from different vertical zones at each individual location.
2. Prior to use at each sampling location, all sampling equipment not previously decontaminated will be cleaned in accordance with Section A.2.1.1.
3. A stainless steel split spoon sampler will be manually driven approximately fifteen (15) inches into the ground.
4. The split spoon sampler will be retrieved and opened upon a double sheet of polyethylene or a sheet of aluminum foil.

5. Using a clean cutting tool, a two- to three-inch section will be removed from the bottom of the core. The remaining core will be cut in half to segregate the top six inches of soil from the underlying six inches. The top six-inch core will be cut in half longitudinally. A continuous sample will be removed from the center of the exposed portion of the top core as illustrated in Figure A-2. The sample will be removed using clean stainless steel spatulas, spoons or other appropriate sampling equipment. The sample shall be placed in a clear, prelabeled, eight-ounce glass jar and sealed with a teflon lined cap.
6. All equipment used during the sampling procedures which may have come in contact with contaminated soils, shall be decontaminated in accordance with Section A.2.1.1. Latex gloves used during the collection of the sample shall be disposed of in accordance with Section 2.1.6.
7. If necessary a second core shall be collected immediately adjacent to the first to retrieve sufficient material for analysis. Where a second core is required for analysis or as a duplicate sample, the collected samples shall be composited and homogenized in a clean stainless steel bowl prior to being placed in the sample jars.
8. A new pair of disposable gloves and clean sampling tools shall be used to prepare the sample from the underlying

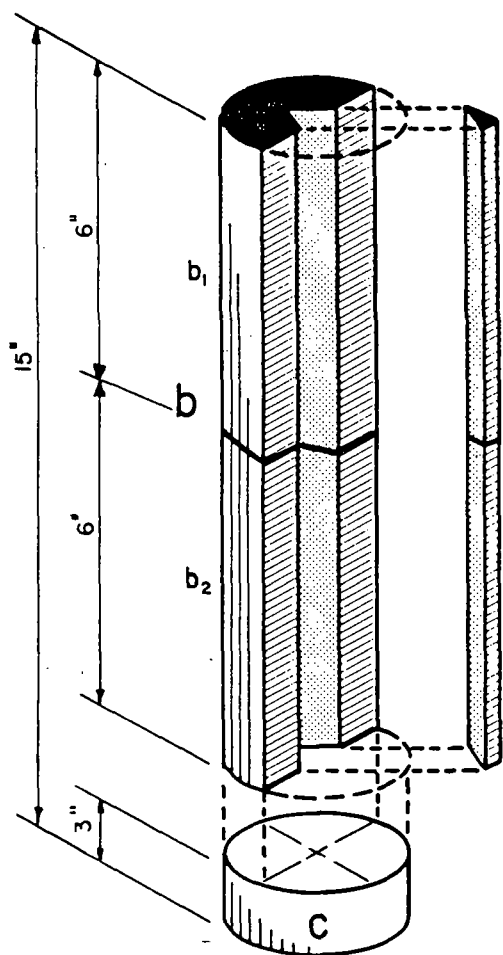
TABLE A-2

ANALYTICAL METHODS SUMMARY

<u>Sample</u>	<u>Parameter</u>	<u>Method for Extraction/Cleanup</u>	<u>Method for Analyses</u>
Soil/Sediment	Total PCBs	3540(1)/3550(1)	8080(1)
	Dioxin/Furan		8280(1)
	Priority Pollutant VOCs	5010/5020/5030(1)	8240(1)
	Priority Pollutant B/N/As (2)	3540/3550(1)	8270(1)
Air	Total Particulate PCBs		5503(3)
	Vaporous PCBs		5503(3)
Groundwater	Total PCBs	3510/3520(1)	8080(1)
	Dioxin/Furan	8280	8280(1)
	Priority Pollutant		
	Volatiles	5010/5020/5030(1)	8240(1)
Surface Water	Total PCBs	3510/3520(1)	8080(1)
	Dioxin/Furan	8280	8280(1)
Concrete Core	Total PCBs	3540/3550(1)	8080(1)
	Dioxin/Furan	8280	8280(1)
Surface Wipe	Total PCBs	3540/3550(1)	8080(1)
	Dioxin/Furan		8280(1)

Notes:

1. Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, Second Edition, SW-846, United States Environmental Protection Agency, 1984.
2. Base, neutral and acid extractable compounds.
3. NIOSH Manual of Analytical Methods, Volume 1, Third Edition, NIOSH Publication No. 84-100, U.S Department of Health and Human Services.



TYPICAL SOIL CORE

a

PORTION OF SAMPLE FOR CHEMICAL ANALYSIS

- CONTACT WITH UNSTERILIZED MATERIALS IS NOT ACCEPTABLE
- CONTAINER : PRECLEANSED 500ml. CLEAR GLASS
- GASKET - TEFLON OR ALUMINIUM FOIL
- a₁ - SURFACE SAMPLE FOR CHEMICAL ANALYSIS
- a₂ - SUB-SURFACE SAMPLE FOR FUTURE ANALYSIS, IF REQUIRED

b

PORTION OF SAMPLE TO BE RETAINED FOR GEOLOGIC RECORDS (IF REQUIRED)

- CONTACT WITH UNSTERILIZED MATERIALS IS NOT A PROBLEM
- CONTAINER : - CLEAN GLASS JAR
- CLEAR GLASS IS SUITABLE
- GASKET - ANY SUITABLE GASKET
- a₁ b₁ - SURFACE SAMPLE FOR GEOLOGIC RECORD
- a₂ b₂ - SUB-SURFACE SAMPLE FOR GEOLOGIC RECORD

c

PORTION OF SAMPLE TO BE DISCARDED

figure A-2

SAMPLE SELECTION DETAILS
FORMER P.R. MALLORY PLANT SITE
Crawfordsville, Indiana

six inches in accordance with the procedures described for preparation of the surface sample.

All surficial soil samples shall be analyzed for total PCBs; ten percent of the soil samples collected shall be analyzed for dioxins and dibenzofurans. In addition to the above, ten percent of all samples collected from Sample Area A, as illustrated on Figure A-1, will be analyzed for priority pollutant base, neutral and acid extractables and volatile organic compounds. *heavy metals*

*in ^{CC} degraded } inorganic,
Sample*

A.2.1.3 Sampling Beneath Concrete Slab

A portable core drill equipped with a three or four-inch diameter core will be used to obtain core samples from the existing concrete slab at the proposed sampling locations. The concrete cores will be retained as an additional sample; cores will be placed in zip-lock plastic bags, labelled and sealed within a second zip-lock plastic bag. The core shall be analyzed for PCB's; one subsurface soil sample shall also be analyzed for dioxins and dibenzofurans.

Subsurface soil samples will be taken beneath the slab using a split spoon sampler as outlined in Section A.2.1.2. The five soil samples taken from beneath the concrete slab shall be analyzed for total PCBs.

A.2.1.4 Sediment Sample Collection

Sediment samples will be collected by driving a three-inch diameter split spoon sampler 15 inches into the sediment at the locations to be sampled following the protocol described in Section A.2.1.2.

Sediment samples will be collected in precleaned, prelabeled 500 mL glass jars as described in Section A.2.2.5. All sediment samples shall be analyzed for total PCBs; the background sample and one downstream sample from Little Sugar Creek as well as one sample from the ravine shall also be analyzed for dioxin and dibenzofuran.

Sampling of sediments shall begin with the downstream sample from Little Sugar Creek and proceed upstream. Sediment samples from the ravine shall be taken following collection of samples from Little Sugar Creek. The first sample shall be taken at Little Sugar Creek and sampling shall then proceed upstream.

A.2.1.5 Soil Sample Handling

Each soil sample jar shall be prelabeled, immediately before the samples are collected, with the following information:

1. project name - 1916 - Conestoga-Rovers & Associates
2. project location - Crawfordsville, Indiana
3. sample identification number;
4. date; and
5. the sampler's name.

The label will be sealed in clear plastic tape to ensure it does not peel off or become damaged.

Following collection of the sample, each sample jar shall be enclosed in a polyethylene zip-lock bag and sealed. Each sample to be transported to the analytical laboratory will be logged on the Sample Transport Chain of Custody Sheet. Samples will be stored in an ice chest packed with vermiculite to cushion the samples during shipment. The ice chest shall be sealed with fibreglass strapping tape; a security seal shall be placed on the ice chest prior to shipping.

A.2.1.6 Waste Material Handling

All waste material generated from the soil sampling program including coveralls, gloves and discarded ground sheets and decontamination fluids shall be placed in 55-gallon drums and securely capped. Solid and liquid waste materials will be placed in separate containers. All waste

material placed in the containers shall be logged and the containers shall be stored on site within the interim staging cell.

Containers shall be placed in interim storage at the end of each day. The final disposition of sampling material shall be carried out in accordance with Section 2.6 of the RAWP.

A.2.1.7 Sample Station Survey

All sampling stations will be marked with a survey stake and identified by a specific location number. All sampling locations will be referenced to horizontal control previously established on site; the elevation of each sampling location will also be determined. Elevations shall be determined to the nearest one-hundreth of a foot; horizontal control will be determined to the nearest one-tenth of a foot.

A.2.1.8 Soil Sampling Procedure Modifications

As field conditions dictate and as approved by USEPA's OSC, the sampling and handling procedures may be modified to control cross-contamination of samples and/or expedite work progress.

A.3 AMBIENT AIR SAMPLING

A.3.1 Sampling

where are sampling locations
Two personal sampling pumps will be used at each of four sampling locations. One of the pumps will be designated for collection of particulate PCB, and the second one will be utilized for the collection of PCB in the gaseous phase.

The pump dedicated to particulate sampling will be equipped with a filter cassette containing a 13 millimeter (mm) glass fiber filter. The pump will be set to collect at a continuous flow rate of 0.2 Litres/minute (L/min.). On completion of sampling, the time of sample collection will be noted and the glass fiber filter will be transferred to a 40 mL glass vial for shipment to the analytical laboratory.

The second pump, dedicated to collection of PCB in vapor or gaseous phase, will be equipped with a florasil tube (100 mg/50 mg). The tube will be opened immediately prior to initiating sampling and attached in-line with the pump. A constant flow rate of 0.5 L/min will be used in order to reduce the possibility of break through on the sample tube. At the close of the sampling period, the total time will be noted and the sample tube will be removed

and capped securely with plastic caps on both ends. The samples will be refrigerated until and during shipment in order to reduce the possibility of loss of sample through volatilization.

Samples will be shipped via overnight courier to the designated laboratory under Chain of Custody.

on-going air sampling?

A.3.2 Sample Pump Calibration

All sampling pumps will be calibrated with a primary calibration unit (e.g. Roots meter) prior to commencing sample collection. Daily calibration will be made with a secondary calibration unit (e.g. rotameter). Daily calibration will take place prior to the sampling period and at the close of the sampling period to verify that the flow rates remained constant throughout the sampling period. This data will be maintained throughout the project as part of the air monitoring data.

A.4 GROUNDWATER SAMPLING

All monitoring wells installed during this program will be sampled according to the following protocols. Table A-1 summarizes the number of samples to be collected.

1. New disposable latex gloves will be used when sampling each well. Additional glove changes will be made for each sampling.
2. Upon removal of the locking and protective caps, measurements of organic vapors of the air in the well head will be made with a HNU meter.
3. The sampler shall measure and record the depth to water in each well to the nearest 0.01 foot using an electric tape. The electric tape will be decontaminated prior to use in each well.
4. Prior to sampling, each well will be prebailed using a stainless steel bottom filling bailer to remove a minimum of three to five times the standing water volume in the well or until dry. In the event that a well is bailed dry prior to achieving three well volumes, groundwater will be permitted to recover to a level sufficient for sample collection; the time the well was bailed dry will be noted and well recovery will be monitored. Upon recovery, one final bailer volume will then be used for sample collection. Prior to use in the initial and all subsequent monitoring wells, the bailer will be precleaned with distilled water, methanol, hexane, methanol and distilled water rinse sequence. Purged groundwater not used for sampling will be collected and contained.

5. After the required standing well water has been purged or immediately after well development, water samples will be collected using a bailer attached to a nylon rope. The bailer will be precleaned using the prescribed sequence from Section A.4.0 prior to use in any monitoring wells. New nylon rope will be used for each monitoring well.

6. All groundwater samples collected for PCBs, dioxin, dibenzofuran and inorganic metals will be filtered in the field as soon as possible after collection. In the case of the inorganic metals, filtering will be done prior to the addition of any preservatives. Filtering will be undertaken with a vacuum filtration device and 0.45 micron filter paper. Groundwater samples for collected priority pollutant volatiles will not be field filtered.

decontaminate
device
before
between
samples

7. Samples will be collected from each well, for the analysis of indicator parameters as follows:

(a) Priority Pollutant Volatiles

Samples for priority pollutant volatile analysis will be collected in two 40 mL amber glass septum vials. The vials will be completely filled and will be free of air bubbles. Samples will be immediately placed in coolers and ice.

(b) PCB

Samples for PCB analysis will be collected in one-litre amber glass bottles, with no preservative added.

(c) Dioxin and Dibenzofuran

Samples for dioxin and dibenzofuran will be collected in one-litre amber glass bottles.

(d) Inorganic Metals and Alkalinity

Samples for inorganic metals (Ca, Mg, Na and K) and Alkalinity will be collected in 500 ml plastic bottles preserved with HNO_3 to a pH of less than 2.

(d) Inorganic Non-Metals

Samples for inorganic non-metals will be collected in one-litre plastic bottles with no preservatives added. The samples will be stored on ice and cooled to 4°C.

8. A blind duplicate sample and matrix spike sample will be collected at a frequency of one per sample round.
9. A bailer rinse water sample will be collected at a frequency of one per sample round. The rinse water sample will consist of distilled water poured into, and

then sampled out of, a bailer cleaned using the prescribed rinse sequence. This will provide a quality assurance check on the field decontamination procedures, employed for the bailers between wells.

10. A matrix spike sample will be collected at a frequency of one per sample round. The matrix spike sample will be collected at twice the normal volume outlined in (7) above.
11. All disposable gloves, rinsings and nylon ropes will be collected and contained on-site in an interim storage cell.

A.5 SURFACE WATER SAMPLING

Surface water samples will be collected, if possible, at all stream sediment sampling locations. The surface water samples will be collected prior to collection of the stream sediment samples at each location.

Surface water samples will be collected by the grab sample method directly into precleaned sample containers. A one-litre wide mouth glass jar will be collected for analysis from each location.

A.6 SURFACE WIPE SAMPLING

Surface wipe samples from decontaminated debris will be collected and analyzed for Total PCBs in accordance with the protocols outlined in Attachment 2.

A.7 ANALYTICAL PROTOCOLS

A.7.1 GENERAL

Samples may contain hazardous constituents, therefore, samples shall be handled at all times with the utmost care to reduce any threat to the public or the environment.

All analytical work shall be performed by a qualified laboratory or laboratories approved by USEPA.

A.7.2 SAMPLE DELIVERY

Samples shall be delivered to the analytical laboratory by commercial courier under approved chain of custody procedures. Laboratory personnel must complete the chain of custody form upon receipt of the samples in accordance with Section A.7.6.

A.7.3 ANALYTICAL PROTOCOLS

Analytical protocols for determining specific parameters shall be as outlined on Table A-2.

A.7.4 QUALITY ASSURANCE/QUALITY CONTROL

Laboratory QA/QC required by the Methods specified in Section A.7.3 shall be strictly followed. Field blanks and duplicate samples shall be collected during sampling; ten percent of the samples collected shall be field blanks and ten percent shall be duplicates as outlined in Table A-1.

A.7.5 SAMPLE BOTTLE PREPARATION

.1 Containers

Sample jars will be supplied by the analytical laboratory for the collection of all samples. All sample bottles will be precleaned by the laboratory and stored at the sampling site in an area and in manner to prevent breakage and contamination of the cleansed bottles. Trip blanks for VOC will be included with bottles shipped to the site.

.2 Cleaning Protocol

All sample containers to be used for collection of samples for chemical analysis will be pre-cleaned and sealed by the laboratory prior to shipment to the site.

A.7.6 CHAIN OF CUSTODY PROCEDURES

.1 Laboratory Custody Procedures

The laboratory will designate a "sample custodian" and an alternate to act in his absence. In addition, the laboratory will set aside as a "sample storage security area" an isolated room which should be secured and have limited access.

The custodian will receive the incoming samples and indicate receipt by signing the Sample Chain of Custody Record Sheet accompanying the samples and retain the sheet as a permanent record. The custodian should check to ensure that the sample numbers indicated on the Custody Form correspond with the sample jar identification numbers. All incoming samples will be entered into a laboratory sample logbook.

Immediately upon receipt, the custodian will place samples in the sample room which shall be secured at all times except when samples are removed or replaced by the custodian.

The custodian shall maintain the integrity of the samples by appropriate storage and must distribute samples to the personnel who are to perform tests.

The analyst must record information in his laboratory notebook or analytical work sheet, that describes the samples, the procedures performed and the results of the tests. The notes must be retained as a permanent record in the laboratory and should include any abnormalities which occurred during the testing procedure.

Standard methods of laboratory analysis must be used as described in Section A.7.3.

Laboratory personnel are responsible for the care and custody of a sample once it is handed over to them and shall be prepared to testify that the sample was in their possession and viewed or secured in the laboratory at all times from the moment it was received from the custodian until the tests were run.

Once the sample testing is completed, the unused portion of the sample together with all identifying tags, laboratory records, and other documentation of work must be returned to the custodian for filing in a secured file location.

.2 Sample Chain of Custody Record Sheet

The Sample Chain of Custody Record Sheet will be introduced into the analytical chain at the time of soil sample collection. The Sample Chain of Custody Record Sheet will be completed for each sample collected and will accompany the sample until it is ultimately disposed of. Figure A-3 presents an example of the Sample Chain of Custody Record Sheet.

The use of the custody sheet will be as follows:

1. The Site Sampler will fill in all required information from the sample labels upon collection of soil samples.
2. The original custody form will be sealed in plastic and placed within the shipping container.

3. The shipping container will be sealed with a numbered security seal.
4. Custody will be transferred to the analytical laboratory which will check the integrity of the security seal upon receipt and retrieve the custody form from the shipping container.
5. Sample disposal will be done by the laboratory. Upon disposal, the laboratory will sign the next open "Relinquished by" box, and words "Disposed" will be written in the "Received by" box.

CRA Consulting Engineers CONESTOGA-ROVERS & ASSOCIATES LIMITED 651 Colby Drive, Waterloo, Ontario Canada N2V 1C2 Telephone (519) 884-0510					SHIPPED TO (Laboratory name):					
<h2 style="margin: 0;">CHAIN OF CUSTODY RECORD</h2>				PROJECT NO.		PROJECT NAME :				
SAMPLER'S SIGNATURE _____ <div style="text-align: center; font-size: small;">(SIGN)</div>					SAMPLE TYPE		NR. OF CONTAINERS		REMARKS	
SEQ. NO.	SAMPLE NO.	DATE	TIME	SAMPLE LOCATION						
TOTAL NO. OF CONTAINERS _____										

RELINQUISHED BY: 1 _____ <div style="text-align: center; font-size: x-small;">(SIGN)</div>	DATE / TIME _____	RECEIVED BY: 2 _____ <div style="text-align: center; font-size: x-small;">(SIGN)</div>
RELINQUISHED BY: 2 _____ <div style="text-align: center; font-size: x-small;">(SIGN)</div>	DATE / TIME _____	RECEIVED BY: 3 _____ <div style="text-align: center; font-size: x-small;">(SIGN)</div>
RELINQUISHED BY: 3 _____ <div style="text-align: center; font-size: x-small;">(SIGN)</div>	DATE / TIME _____	RECEIVED BY: 4 _____ <div style="text-align: center; font-size: x-small;">(SIGN)</div>
RELINQUISHED BY: 4 _____ <div style="text-align: center; font-size: x-small;">(SIGN)</div>	DATE / TIME _____	RECEIVED BY: 5 _____ <div style="text-align: center; font-size: x-small;">(SIGN)</div>

METHOD OF SHIPMENT:	SHIPPED BY:	RECEIVED FOR LABORATORY BY: _____ <div style="text-align: center; font-size: x-small;">(SIGN)</div>	DATE / TIME _____
CONDITION OF SEAL UPON RECEIPT: GENERAL CONDITION OF COOLER:		COOLER OPENED BY: _____ <div style="text-align: center; font-size: x-small;">(SIGN)</div>	DATE / TIME _____

WHITE - RECEIVING LABORATORY COPY
 YELLOW - SHIPPER'S COPY
 PINK - CRA LABORATORY COPY
 GOLDEN ROD - CRA OFFICE COPY

CRA

ATTACHMENT 1

USEPA METHODS FOR FIELD MEASUREMENTS

SPECIFIC CONDUCTANCE

PH

TEMPERATURE

CONDUCTANCE

Method 120.1 (Specific Conductance, μmhos at 25°C)

STORET NO. 00095

1. Scope and Application
 - 1.1 This method is applicable to drinking, surface, and saline wates, domestic and industrial wastes and acid rain (atmospheric deposition).
2. Summary of Method
 - 2.1 The specific conductance of a sample is measured by use of a self-contained conductivity meter, Wheatstone bridge-type, or equivalent.
 - 2.2 Samples are preferable analyzed at 25°C. If not, temprature corrections aremade and results reported at 25°C.
3. Comments
 - 3.1 Instrument must be standardized with KCl solution before daily use.
 - 3.2 Conductivity cell must be kept clean.
 - 3.3 Field measurements with comparable instruments are reliable.
 - 3.4 Temperature variations and corrections represent the largest source of potential error.
4. Sample Handling and Preservation
 - 4.1 Analyses can be performed either in the field or laboratory.
 - 4.2 If analysis is not completed within 24 hours of sample collection, sample should be filtered through a 0.45 micron filter and stored at 4°C. Filter and apparatus must be washed with high quality distilled water and pre-rinsed with sample before use.
5. Apparatus
 - 5.1 Conductivity bridge, range 1 to 1000 μmho per centimeter.
 - 5.2 Conductivity cell, cell constant 1.0 or micro dipping type cell with 1.0 constant. YSI #3403 or equivalent.
 - 5.4 Thermometer
6. Reagents
 - 6.1 Standard potassium chloride solutions, 0.01 M: Dissolve 0.7456 gm of pre-dried (2 hour at 105°C) KCl in distilled water and dilute to 1 liter at 25°C.
7. Cell Calibration
 - 7.1 The analyst should use the standard potassium chloride solution (6.1) and the table below to check the accuracy of the cell constant and conductivity bridge.

Approved for NPDES

Issued 1971.

Editorial revision, 1982

Conductivity 0.01 m KCl

°C	Micromhos/cm
21	1305
22	1332
23	1359
24	1386
25	1413
26	1441
27	1468
28	1496

8. Procedure

8.1 Follow the direction of the manufacturer for the operation of the instrument.

8.2 Allow samples to come to room temperature (23 to 27°C), if possible.

8.3 Determine the temperature of samples within 0.5°C. If the temperature of the samples is not 25°C, make temperature correction in accordance with the instruction in Section 9 to convert reading to 25°.

9. Calculation

9.1 These temperature corrections are based on the standard KCl solution.

9.1.1 If the temperature of the sample is below 25°C, add 2% of the reading per degree.

9.1.2 If the temperature is above 25°C, subtract 2% of the reading per degree.

9.2 Report results as Specific Conductance, $\mu\text{mhos/cm}$ at 25°.

10. Precision and Accuracy

10.1 Forty-one analysts in 17 laboratories analyzed six synthetic water samples containing increments of inorganic salts, with the following results:

<u>Increment as Specific Conductance</u>	<u>Precision as Standard Deviation</u>	<u>Bias, %</u>	<u>Accuracy as Bias, $\mu\text{mhos/cm}$</u>
100	7.55	-2.02	-2.0
106	8.14	-0.76	-0.8
808	66.1	-3.63	-29.3
848	79.6	-4.54	-38.5
1640	106	-5.36	-87.9
1710	119	-5.08	-86.9

(FWPCA Method Study 1, Mineral and Physical Analyses.)

10.2 In a single laboratory (EMSL) using surface water samples with an average conductivity of 536 $\mu\text{mhos/cm}$ at 25°C, the standard deviation was ± 6 .

Bibliography

1. The procedure to be used for this determination is found in:
Annual Book of ASTM Standards Part 31, "Water," Standard D1125-64, p. 120 (1976).
2. Standard Methods for the Examination of Water and Wastewater, 14th Edition, p. 71,
Method 205 (1975).
3. Instruction Manual for YSI Model 31 Conductivity Bridge.
4. Peden, M. E., and Skowron. "Ionic Stability of Precipitation Samples," Atmospheric
Environment, Vol. 12, p. 2343-2344, 1978.

pH

Method 150.1 (Electrometric)

STORET NO.

Determined on site 00400

Laboratory 00403

1. Scope and Application
 - 1.1 This method is applicable to drinking, surface, and saline waters, domestic and industrial wastes and acid rain (atmospheric deposition).
2. Summary of Method
 - 2.1 The pH of a sample is determined electrometrically using either a glass electrode in combination with a reference potential or a combination electrode.
3. Sample Handling and Preservation
 - 3.1 Samples should be analyzed as soon as possible preferably in the field at the time of sampling.
 - 3.2 High-purity waters and waters not at equilibrium with the atmosphere are subject to changes when exposed to the atmosphere, therefore the sample containers should be filled completely and kept sealed prior to analysis.
4. Interferences
 - 4.1 The glass electrode, in general, is not subject to solution interferences from color, turbidity, colloidal matter, oxidants, reductants or high salinity.
 - 4.2 Sodium error at pH levels greater than 10 can be reduced or eliminated by using a "low sodium error" electrode.
 - 4.3 Coatings of oily material or particulate matter can impair electrode response. These coatings can usually be removed by gentle wiping or detergent washing, followed by distilled water rinsing. An additional treatment with hydrochloric acid (1 + 9) may be necessary to remove any remaining film.
 - 4.4 Temperature effects on the electrometric measurement of pH arise from two sources. The first is caused by the change in electrode output at various temperatures. This interference can be controlled with instruments having temperature compensation or by calibrating the electrode-instrument system at the temperature of the samples. The second source is the change of pH inherent in the sample at various temperatures. This error is sample dependent and cannot be controlled, it should therefore be noted by reporting both the pH and temperature at the time of analysis.
5. Apparatus
 - 5.1 pH Meter-laboratory or field model. A wide variety of instruments are commercially available with various specifications and optional equipment.

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Editorial revision 1978 and 1982

- 5.2 Glass electrode.
- 5.3 Reference electrode—a calomel, silver-silver chloride or other reference electrode of constant potential may be used.
NOTE 1: Combination electrodes incorporating both measuring and reference functions are convenient to use and are available with solid, gel type filling materials that require minimal maintenance.
- 5.4 Magnetic stirrer and Teflon-coated stirring bar.
- 5.5 Thermometer or temperature sensor for automatic compensation.
- 6. Reagents
 - 6.1 Primary standard buffer salts are available from the National Bureau of Standards and should be used in situations where extreme accuracy is necessary.
 - 6.1.1 Preparation of reference solutions from these salts require some special precautions and handling⁽¹⁾ such as low conductivity dilution water, drying ovens, and carbon dioxide free purge gas. These solutions should be replaced at least once each month.
 - 6.2 Secondary standard buffers may be prepared from NBS salts or purchased as a solution from commercial vendors. Use of these commercially available solutions, that have been validated by comparison to NBS standards, are recommended for routine use.
- 7. Calibration
 - 7.1 Because of the wide variety of pH meters and accessories, detailed operating procedures cannot be incorporated into this method. Each analyst must be acquainted with the operation of each system and familiar with all instrument functions. Special attention to care of the electrodes is recommended.
 - 7.2 Each instrument/electrode system must be calibrated at a minimum of two points that bracket the expected pH of the samples and are approximately three pH units or more apart.
 - 7.2.1 Various instrument designs may involve use of a “balance” or “standardize” dial and/or a slope adjustment as outlined in the manufacturer’s instructions. Repeat adjustments on successive portions of the two buffer solutions as outlined in procedure 8.2 until readings are within 0.05 pH units of the buffer solution value.
- 8. Procedure
 - 8.1 Standardize the meter and electrode system as outlined in Section 7.
 - 8.2 Place the sample or buffer solution in a clean glass beaker using a sufficient volume to cover the sensing elements of the electrodes and to give adequate clearance for the magnetic stirring bar.
 - 8.2.1 If field measurements are being made the electrodes may be immersed directly in the sample stream to an adequate depth and moved in a manner to insure sufficient sample movement across the electrode sensing element as indicated by drift free (<0.1 pH) readings.
 - 8.3 If the sample temperature differs by more than 2°C from the buffer solution the measured pH values must be corrected. Instruments are equipped with automatic or manual

⁽¹⁾National Bureau of Standards Special Publication 260.

compensators that electronically adjust for temperature differences. Refer to manufacturer's instructions.

- 8.4 After rinsing and gently wiping the electrodes, if necessary, immerse them into the sample beaker or sample stream and stir at a constant rate to provide homogeneity and suspension of solids. Rate of stirring should minimize the air transfer rate at the air water interface of the sample. Note and record sample pH and temperature. Repeat measurement on successive volumes of sample until values differ by less than 0.1 pH units. Two or three volume changes are usually sufficient.
- 8.5 For acid rain samples it is most important that the magnetic stirrer is not used. Instead, swirl the sample gently for a few seconds after the introduction of the electrode(s). Allow the electrode(s) to equilibrate. The air-water interface should not be disturbed while measurement is being made. If the sample is not in equilibrium with the atmosphere, pH values will change as the dissolved gases are either absorbed or desorbed. Record sample pH and temperature.
9. Calculation
 - 9.1 pH meters read directly in pH units. Report pH to the nearest 0.1 unit and temperature to the nearest °C.
10. Precision and Accuracy
 - 10.1 Forty-four analysts in twenty laboratories analyzed six synthetic water samples containing exact increments of hydrogen-hydroxyl ions, with the following results:

pH Units	Standard Deviation pH Units	Bias, %	Accuracy as Bias, pH Units
3.5	0.10	-0.29	-0.01
3.5	0.11	-0.00	
7.1	0.20	+1.01	+0.07
7.2	0.18	-0.03	-0.002
8.0	0.13	-0.12	-0.01
8.0	0.12	+0.16	+0.01

(FWPCA Method Study 1, Mineral and Physical Analyses)

- 10.2 In a single laboratory (EMSL), using surface water samples at an average pH of 7.7, the standard deviation was ± 0.1 .

Bibliography

1. Standard Methods for the Examination of Water and Wastewater, 14th Edition, p 460, (1975).
2. Annual Book of ASTM Standards, Part 31, "Water", Standard D1293-65, p 178 (1976).
3. Peden, M. E. and Skowron, L. M., Ionic Stability of Precipitation Samples, Atmospheric Environment, Vol. 12, pp. 2343-2349, 1978.

TEMPERATURE

Method 170.1 (Thermometric)

STORET NO. 00010

1. Scope and Application
 - 1.1 This method is applicable to drinking, surface, and saline waters, domestic and industrial wastes.
2. Summary of Method
 - 2.1 Temperature measurements may be made with any good grade of mercury-filled or dial type centigrade thermometer, or a thermistor.
3. Comments
 - 3.1 Measurement device should be routinely checked against a precision thermometer certified by the National Bureau of Standards.
4. Precision and Accuracy
 - 4.1 Precision and accuracy for this method have not been determined.
5. Reference
 - 5.1 The procedure to be used for this determination is found in:
Standard Methods for the Examination of Water and Wastewater, 14th Edition, p 125, Method 212 (1975).

Approved for NPDES
Issued 1971

ATTACHMENT 2

SAMPLING AND ANALYSIS OF SURFACES
FOR POLYCHLORINATED BIPHENYLS,
DIBENZOFURANS AND DIBENZODIOXINS

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1.0 OBJECTIVE

The objective of this test plan is to determine, by state-of-the-art methodologies, the surface concentrations of polychlorinated biphenyls (PCBs), polychlorinated dibenzofurans (PCDFs) and polychlorinated dibenzo-p-dioxins (PCDDs) within the area of the Former P. R. Mallory Plant site, Crawfordsville, Indiana. The test is intended to provide adequate data for the determination of the extent of surface contamination

2.0 SAMPLING METHODOLOGY

Measurement of surface concentrations of PCBs, PCDFs and PCDDs will be conducted using equipment and techniques which have been developed and approved for use in the Binghamton (New York) State Office Building, where a transformer fire occurred in February 1981 [4]. This methodology also has been applied to a transformer fire in San Francisco [3] and two transformer incidents in Tulsa [5, 6].

2.1 SUGGESTED METHOD FOR SURFACE WIPE SAMPLING - PCBs, PCDFs, AND PCDDs

Surface samples for PCBs, PCDFs, and PCDDs will be collected according to the wet-wipe protocol

established by the New York State Department of Health for surfaces in the Binghamton State Office Building. This wet-wipe protocol was also used to assess these contaminants resulting from transformer fires in San Francisco [3] and Tulsa [5].

The surface wipe samples are collected using 3-inch x 3-inch soxhlet extracted cotton gauze pads. The sampling procedure consists of marking off a surface into 0.25 m² areas using a template or an appropriate measuring device. Each area is wiped with a 3-inch x 3-inch gauze pad which has been wetted with 8 ml of pesticide grade hexane. The wet wipe sample pad will be held with a gloved hand, which is changed with each sample. The surface is wiped in two directions (the second direction is performed at a 90° angle to the first direction). Each gauze pad is used to wipe only one 0.25 m² area. The gauze pad sample is placed in a glass sample container equipped with a Teflon lined lid.(A)

Each PCB wipe sample will consist of a single sample from an area of 0.25 m². Each PCDF/PCDD wipe sample

(A) For instances where a template may not be used, the area actually wiped must be determined accurately, for quantitation purposes.

will consist of a composite of four 0.25 m² wipe samples for a total area of 1.0 m². The four PCDF/PCDD gauze pads are composited and treated as a single sample to attain an acceptable detection limit.

3.0 SAMPLE CHAIN-OF-CUSTODY PROCEDURES

Sample chain-of-custody procedures are an integral activity of both sampling and analytical activities. Chain-of-custody procedures provide documentation of samples through all phases of activities from the time the sampling devices are prepared to be sent to the field through reporting of the analytical results. Sample chain-of-custody will be initiated by the sampling personnel upon receipt of the sampling devices.

4.0 ANALYTICAL METHODOLOGY

The surface wipe samples for PCDF/PCDD analysis will be completed by Hazleton Laboratories using EPA method 8280. The surface wipe samples for PCB analysis will be completed by Envirotech Laboratories using EPA method 8080 as outlined in Table A-2 of Appendix A.

5.0 REFERENCES

1. Orris, P., Kominsky, J.R., Hocyhorczuk, D. and Melius, J.M. Exposure to Polychlorinated Biphenyls from an Overheated Transformer. Presented at the 5th International Symposium on Chlorinated Dioxins and Related Compounds. September 1985, Bayreuth (FRG).
2. Interim test report. Test results of air, surfaces and bulk materials in the New Mexico State Highway Department Building. (Unpublished report submitted to New Mexico State Highway Department by Blackman-Mooring Steamatic Catastrophe, Inc., Fort Worth, Texas, July 11, 1985.)
3. Sampling and Analysis of Selected Chemicals on Surfaces and Air: Steuwart Street Tower, One Market Plaza, San Francisco, CA. (Unpublished report submitted to Tishman-West Management Corp. by Versar, Inc., Springfield, Virginia, December 2, 1983.)
4. Schecter, A. Contamination of an Office Building in Binghamton, New York, by PCBs, Dioxins, Furans and Biphenylenes after an Electrical Panel and Electrical Transformer Incident. Chemosphere, Vol. 12, No. 415, pp. 669-680, 1983.

5. Health Hazard Evaluation Project NO. HETA 84-230.
National Institute for Occupational Safety and Health,
Cincinnati, Ohio 1985.
6. Health Hazard Evaluation Project NO. HETA 84-289.
National Institute for Occupational Safety and Health,
Cincinnati, Ohio 1985.
7. Smith, R.M., Hilker, D., O'Keefe, P., Aldous, K.
Determination of tetra-hexa CDFs and tetra-CDDs in air
samples from the 11, 14, 16 and 17th floors of the
Binghamton State Office Building. (Unpublished report.
New York State Department of Health, Laboratory for
Organic Analytical Chemistry, Albany, New York, May
1983.)
8. Smith R.M., Hilker, D., O'Keefe, P., Aldous, K.
Determination of TCDFs and TCEDDs in air samples from the
sixteenth floor of the Binghamton State Office Building.
(Unpublished report. New York State Department of
Health, Toxicology Institute, Albany, New York, May
1983.)
9. Aldous, K., Hilker, D., O'Keefe, P., Smith, R. and
Eadon, G. Chemical Data on Air and Wipe Samples
Collected from the Binghamton State Office Building -
September 1984 (Unpublished report. New York State
Department of Health, Albany, New York.)

10. Eadon, G., Aldous, K., Hilker, D., O'Keefe, P. and Smith, R. Chemical Data on Air Samples from the Binghamton State Office Building. (Unpublished report. New York State Department of Health, Albany, New York.)
11. Smith, R., O'Keefe, P., Hilker, R. and Aldous, K. Determination of pg/m^3 Concentrations of Chlorinated Dibenzofurans and Dibenzo-p-dioxins in Air Samples from a Contaminated Building by High Resolution Gas Chromatography/High Resolution Gas Spectrometry. (Submitted for publication in J. Analytical Chemistry, 1985.)
12. NIOSH manual of analytical methods. 3rd ed. Cincinnati: U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control National Institute for Occupation Safety & Health, 1984; DHHS (NIOSH) publication no 84-100:5503-1 to 5503-5.
13. Westin, R. Fires Involving PCBs: Effectiveness of Cleaning Procedures and Quality Controls Requirements. In: Proceedings of the 1984 polychlorinated dibenzofuran workshop. Palo Alto: Electric Power Research Institute, 1985.
14. Kushner, E.J. On Determining the Statistical Parameters for Pollution Concentration from A Truncated Data Set. Atmospheric Environment Vol. 10, page 975-979 (1976).

15. Nehls, G.J. and Akland, G.G. Procedures for Handling
Aerometric Data. J. Air Pollution Control Assoc. Vol.
23, pages 180-184 (1973).

APPENDIX B

OBSERVATION WELL INSTALLATION PROTOCOLS

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B.1 INTRODUCTION

Seven observation wells will be installed at five locations during this program to determine the following:

- i) site stratigraphy,
- ii) horizontal and vertical direction of groundwater flow, and,
- iii) distribution of groundwater contamination, if any.

The protocols to be used for the monitoring well installation are described in the following sections.

B.2 DRILLING PROCEDURES

At each proposed well nest location the deep borehole will be advanced initially.

The boreholes will be advanced with hollow stem augers with an inside diameter of 4 1/4-inches. Split spoon samples will be collected during augering to identify soil materials as outlined in Section B.3. All materials will be described and classified according to the Unified Soil Classification System.

At the boring locations outside the security fence temporary work sites will be established. At each of these sites, an area around the drilling rig will be demarcated to define a "dirty work zone." Also, a plastic groundsheet overlain by plywood will be lain down over all areas of work travel within the delineated potentially "dirty working zone." All drill cuttings will be contained on the plastic ground sheet.

B.3 SOIL SAMPLING

Continuous split spoon samples will be collected for the uppermost 15 feet; split spoon samples will be collected at 5-foot intervals thereafter. The split spoon sampler will be attached to the drill rod and driven into the soil the full depth (24 inches) using a 140-pound hammer, free-falling 30 inches. The driving resistance (number of hammer blows) will be recorded for each six-inch increment of penetration. If the soil is loose, wet, or in any way unconsolidated, clean basket retainers will be used to retain the soil in the split spoon. Between each sampling the split spoon will be cleaned as described in Section B.6.

Soil samples collected from the split spoon will be described and classified according to the Unified Soil Classification System and then stored in glass jars for

geologic record. All samples retained for geologic record will be stored on site.

During sampling, HNU readings will be taken and recorded as each split spoon is opened, as an indication of volatile organic contamination. Also, HNU readings of the head space of the sample jars will be taken and recorded.

B.4 OBSERVATION WELL CONSTRUCTION

A single observation well will be completed in each borehole. Each monitoring well will be constructed with five feet of 6-slot, 2-inch diameter stainless steel well screen joined to 2-inch diameter stainless steel riser with threaded and coupled joints. Number 4 silica sand will be placed in the borehole annulus to a depth of two feet above the top of the well screen. Should natural conditions prove difficult for sand pack placement, the native materials will be allowed to collapse around the screen. A 2-foot thick bentonite pellet seal will be placed in the annulus above the sand pack material. The bentonite pellets will be high density, approximately 3/8-inch diameter and will be tamped into place to ensure that a good seal is formed. The annulus above the seal will be backfilled with a cement/bentonite grout to ground surface. Surface protection consisting of a 4-inch diameter steel casing, complete with a

lockable cap, will be embedded in the cement/ bentonite grout.

A typical monitoring well installation is shown on Figure B-1.

B.5 WASTE HANDLING

All soil cuttings brought to the surface will be collected in 55-gallon DOT approved drums and transferred to the on-site interim staging cell. Any borehole fluid will also be contained and collected.

All coveralls, gloves, etc. will be collected in plastic bags daily and placed nightly in the designated interim storage area.

B.6 EQUIPMENT CLEANING

Prior to mobilization of the drill rig, the rig-and all associated equipment will be thoroughly steam cleaned to remove oil, grease, mud and other foreign matter. Subsequently, before initiating drilling at each borehole or well location, the augers, cutting bits, samplers, drill steel, and associated equipment will be cleaned to prevent

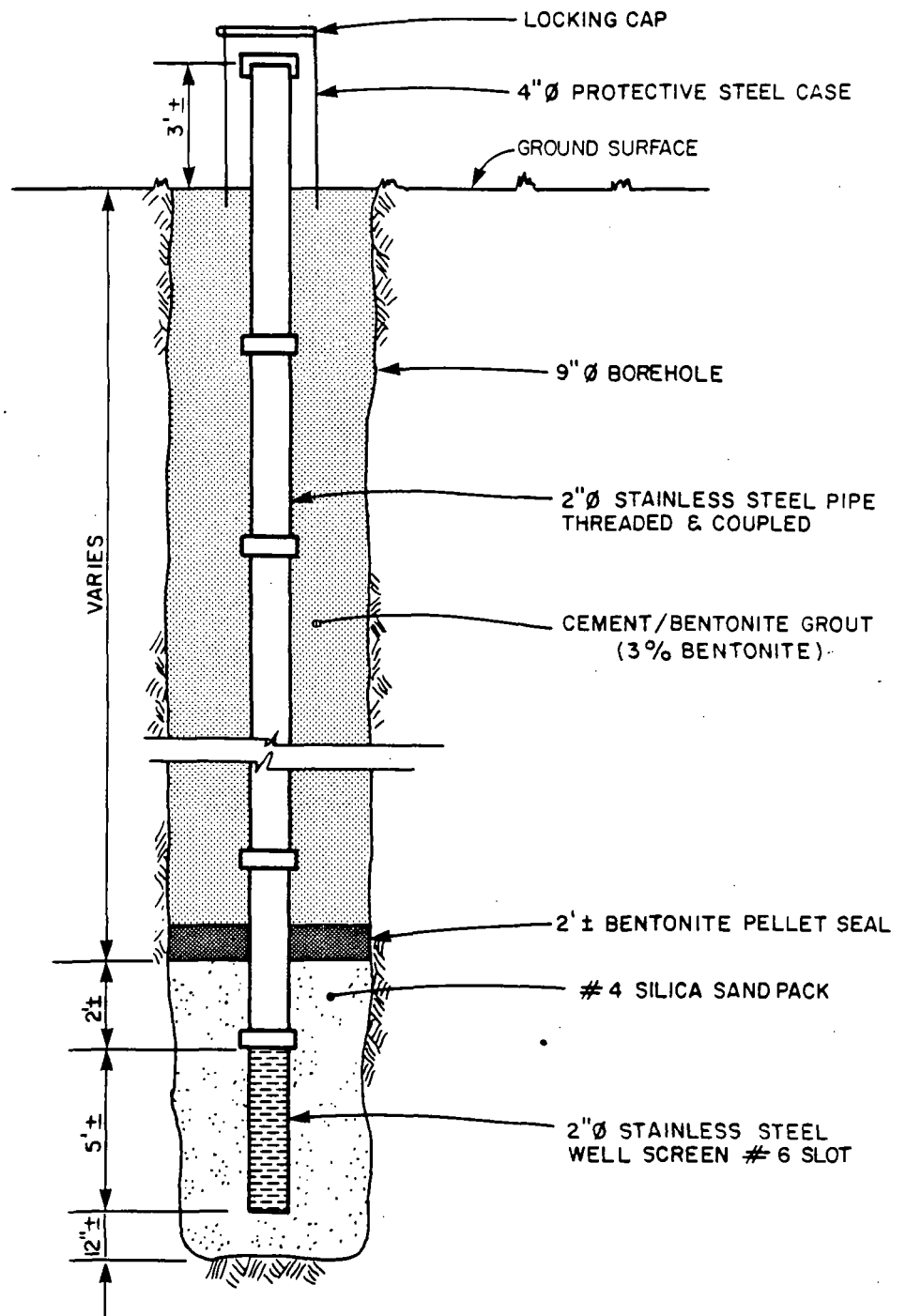


figure B-1
TYPICAL OVERBURDEN MONITORING WELL DETAIL
FORMER P.R. MALLORY PLANT SITE
Crawfordsville, Indiana

cross-contamination from the previous drilling location. All cleaning will be conducted at the the on-site decontamination pad. Cleaning will be accomplished by flushing and wiping the components to remove all visible sediments followed by thorough high pressure wash and rinsing. Special attention will be given to the threaded sections of the drill rods and split spoons. The split spoon will be further cleaned by a methanol/hexane/methanol/deionized water rinse.

Following final rinse, openings will be visually inspected to verify they are free of soil particulates and other solid material which may contribute to possible sample cross-contamination.

Prior to installation of the monitoring wells, the casing and screens will be cleaned with a detergent high pressure wash, followed by methanol/hexane/methanol/deionized water rinses. Equipment will be protected from all forms of solvent contact between final rinse and actual use at the sample site. All solvent rinse liquids will be segregated from wash water and stored on site in the interim staging cell.

B.7 WELL DEVELOPMENT

All wells will be developed to a silt-free condition, if possible, following installation by bailing or pumping. At least three casing volumes will be removed. Field measurements of pH, conductivity and temperature will be taken of the evacuated water. Well development will continue until three consecutive and consistent readings of conductivity and pH are obtained or a maximum of five well volumes have been removed. All development water will be collected, analyzed and disposed of in accordance with State and Federal regulations.

B.8 RESPONSE TESTING

Response testing of all observation wells will be undertaken to determine the in situ horizontal hydraulic conductivity of the screened materials.

This testing involves the displacement of well water by a slug of known volume. Water level measurements are taken as the system stabilizes. Falling head tests are those which monitor a declining water level with time following the introduction of a slug. Following removal of the slug, the water level rises. This comprises a rising head test.

Prior to the introduction of the slug into a well, the slug will be decontaminated in accordance with the method described in Section B.6.0.

The methods of analysis of single well response test data are a function of the well configuration, aquifer type, and the position of the water table relative to that of the screen. The following data analysis methods will be employed as appropriate:

- Hvorslev (1951)
- Cooper et al (1967)
- Papadopoulos et al (1973)
- Bouwer and Rice (1976)